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ABSTRACT

This guide is intended to assist vocational and technical education teachers in implementing competency-based vocational education programs. The first section discusses what competency-based education (CBE) is and is not, the varying degrees to which a course or program can be competency based, and several different approaches to implementing CBE in a classroom or laboratory. The second section, which deals with identifying and validating student competencies, discusses the content of task statements, sources of task statements, procedures for developing a task listing, task verification, and steps in writing performance objectives. The following aspects of instructional delivery in CBE are discussed in the third section: task analysis, evaluation-performance, evaluation-knowledge, development of student learning guides, and CBE in a traditional delivery system. The fourth section, which deals with managing CBE, covers management and implementation, management of program/departmental activities, staff development, student orientation, grading, attendance/progress, task mapping, learning guide production/quality control, and desirable characteristics of a learning resource center. The fifth section contains a glossary and sample forms for use in developing a syllabus, student learning guides, a task listing, and a task analysis. Each section also includes a listing of resource materials. (MN)

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Implementing

Competency-Based Education

A Resource Guide

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Implementing

Competency-Based Education

A Resource Guide

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Introduction

In Texas, many vocational and technical training programs are interested in or moving toward the implementation of competency-based education. The purpose of this publication is to serve as a reference for instructors in obtaining information necessary for successful implementation.

The Resource Guide is divided into five major components. Each component addresses a specific aspect of competency-based education. A resource section is included at the end of each component. This resource section contains documents, samples and examples that support what was previously discussed in the component.

A major goal of this publication is that it will be actually used by instructors. Therefore it does not contain complicated theoretical information or other associated "sophisticated" curriculum design models. It is the authors' intent to provide straightforward information and practical suggestions.

The approach for developing and implementing competency-based education discussed in this manual is one approach and not the only method since no one approach will work effectively in all situations. Hopefully, some or all of the information presented in this publication can be used or modified to meet individual needs.

Component A

Defining Competency-Based Education

Purpose

The purpose of Component A of the Resource Guide is to examine what competency-based education (CBE) is and is not. This component also discusses the varying degrees a program or course can be competency-based and looks at several different approaches of actually implementing CBE in the classroom and lab. It reviews settings where CBE is being successfully utilized in schools, the military, business and industry. Advantages and disadvantages of CBE for students, instructors, and administrators are examined. A resource section is also included presenting examples of how various schools and state agencies define and conceptualize competency-based education.

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The Competency-Based Approach to Education and Training: What Is It and Why Do It?

It seems like educational innovations come and go without really making much of an impact on the overall system. One recent innovation, however is catching on and has already made a significant change in the way education and training are organized and delivered. That innovation is Competency-Based Education, (commonly known as CBE). It often goes by other names such as Competency-Based Instruction (CBI), Mastery Learning (ML), Competency-Based Vocational Education (CBVE), and several others.

Just what is CBE? Why is it catching on throughout the United States? How will it effect the delivery of vocational and technical education in Texas? This resource guide will discuss these and other related questions and issues surrounding competency-based education. **Component** A of the Resource Guide examines what CBE is and what it is not. It looks at the principles and assumptions that form the foundation of the CBE approach. This component also discusses the varying degrees a program or course can be competency-based and looks at several different approaches of actually implementing it in the classroom and lab. It reviews settings where CBE approaches are being successfully utilized in schools, the military, business and industry. Finally, advantages and disadvantages of CBE for students, instructors and administrators are examined.

Just What is CBE?

Many schools in Texas are considering the shift to a competency-based approach for the organization and delivery of vocational technical education. CBE is being viewed not as a gimmick or a panacea but as a practical, highly desirable approach that has proven itself as a useful tool to help vocational educators improve both the efficiency and effectiveness of training programs at the local level.

Unfortunately, much rumor, misinformation and myth surround the competency-based approach to education and training. Adding to the confusion are all the acronyms and labels being used to describe this system such as CBE, CBI, PSI, CRI, etc. and the various definitions of CBE in use as well as the numerous lists of essential and desirable characteristics of CBE being pushed by the "experts". A simplified definition of CBE is:

> **Competency-Based Education (CBE) is an approach in which we clearly state the expected outcomes, we organize and deliver instruction in a manner that maximizes learning for each individual student and we evaluate students on their ability to perform.**

The competency-based approach to education and training as described in this resource guide is simply this:

A **Competency-Based** vocational-technical education program is one that:

Is Competency-Based,	Is organized around and based on precise industry validated statements of student outcomes which clearly describe what the student will be able to do as a result of training. These outcomes are commonly called competencies or tasks.
Uses Mastery Learning,	Organizes and delivers instruction in a manner that to the greatest degree possible and practical focuses on maximizing the learning outcome for each individual student.
and is Performance Oriented.	Grades and evaluates each student primarily on the degree to which he or she demonstrates mastery of the competencies or tasks upon which the training program is based.

As you can see, this definition of CBE describes nothing really new, different or revolutionary. What it does however, is pull together the major elements of good instructional practices that vocational educators have used for years. Good vocational technical education should:

- √ **base instruction on industry validated competencies,**
- √ **deliver instruction with the individual learner foremost in mind,**
- √ **evaluate students based on their ability to actually perform the skill in question.**

In a later section we will take a look at how these three basic elements of CBE can be actually implemented on a day-to-day basis at the local level. We will examine the changes (sometimes minor and sometimes major) that might be needed in curriculum, media, teaching methods, management strategies, grading systems and several other areas to fully implement the competency-based approach in the shop, lab and classroom.

CBE: What It Is Not

Now that we have examined what CBE is; let's take a look at what it is not. On the following pages are some of the more common myths surrounding CBE along with a brief explanation of why each is untrue.

CBE Myths	Explanation
CBE is nothing new	Partially true-the basic elements of CBE are not new; what is new is pulling them all together in an overall, systematic, organized approach to quality vocational-technical education.
Sounds good in theory but it just doesn't work in the classroom and lab	False-the CBE concept has already shown to work quite well in a wide variety of settings (both academic and occupational) when it is carefully developed and implemented.
CBE only works in certain programs	Again CBE approaches are in use in virtually every type of training from such traditional craft areas as saddle making to high technology fields such as laser electro-optics technology.
It just won't work here because "the system" forces us to use letter grades, semesters and other traditional elements	Successful CBE programs, courses and schools are operating quite well within the traditional structure of letter grades, rigid time frames, and structured semesters. What is different with CBE is what happens to learners on a day to day basis within the traditional system!
CBE just lowers standards so everyone can pass	Quite the opposite-in CBE a high standard of performance (typically 90-100% proficiency) is set for each competency and to get credit for mastering that competency students must achieve that level of performance.
It forces everyone to work alone	False-in CBE students often work in small groups, in a large group, and may work alone--all depending on what meets their learning needs best.
CBE is not proven yet	During the past 20 years CBE approaches have been tried in virtually every subject area, in many different settings, and with every type of student. The verdict seems to be that when CBE is well designed and carefully delivered, it works as well as and usually better than the more conventional approach.

CBE Myths	Explanation
CBE is out of step with business and industry because speed and attendance are crucial in a business setting	True-in industry, speed and attendance are important--and so are they in the competency-based approach. In quality CBE programs students must abide by rigid attendance policies and students must perform within industry accepted standards.
Instructors in CBE spend all day shuffling papers	False-where CBE has been appropriately designed and implemented instructors report spending more time working directly with students.
CBE reduces a program or course to a list of low level tasks or competencies	Untrue-one of the advantages of CBE is that it forces training programs to stop and carefully list exactly what is is they want students to do. These outcomes can be low level (assemble, describe, repair, etc.) or higher level (evaluate, recommend, analyze, etc.) depending upon what is appropriate. In CBE we specify exactly what is wanted.
CBE fails to recognize superior performance	In CBE most students do perform more similarly to each other and the average level of performance is higher than in the more traditional approach, however, CBE programs can reward superior performance in a variety of ways.
If we give students flexible learning time, some will take forever	In practice this just does not happen. Studies have clearly shown that when given high quality learning materials slower learning students can pick up the pace and learn almost as quickly as the faster learning students.

While we are discussing CBE misconceptions we need to emphasize that competency-based education and training is an overall general approach to the teaching/learning process and not one particular method or technique for organizing or delivering instruction. Utilizing the competency-based approach does not dictate the use of any particular methodology such as "Individualized Instruction." These two concepts often get confused. A program or course can be "competency-based" without being totally "individualized." Keep in mind however that individualized instruction is a very effective way of implementing the CBE approach.

True, individualized instruction often employs multiple entry dates, complete student self-pacing, modularization of instruction, time flexibility and open exit dates. All these things are nice to have (if appropriate) but are not absolutely essential to CBE. Remember, our definition of CBE includes only three key ingredients:

1) basing the program on competencies,

2) maximizing learning for the individual student,

3) evaluating students on mastery of competencies.

If a competency based program is also highly individualized that is a plus but it does not have to be! CBE is an approach--Individualized Instruction is a method.

What's Wrong With the Present System?

A logical assumption would be that something must be wrong with the present system if this resource guide is recommending the implementation of a new one. That is not the case. The present system of technical training has served Texas well. Our community colleges and vocational technical institutes have graduated thousands upon thousands of excellent graduates who have taken their place within business and industry throughout the state.

When we say "traditional" or "conventional" instruction we are referring to vocational and technical education that is usually characterized by limited enrollment dates (usually once or twice a year), emphasis on covering materials tied to a textbook and often organized into courses, a fixed amount of time spent on each topic (and on the entire course or program), the entire class moving from topic to topic (regardless of how well each student has mastered the present topic), and most or all of the instruction delivered by the instructor through lectures, demonstrations, discussions, etc.

Common shortcomings of conventional or traditional training programs often include:

√ **New students are limited to 2 or 3 enrollment dates throughout the year.**

√ **It is quite difficult to determine exactly what some programs are teaching.**

√ **What is being taught in some programs often lags years behind what is really needed by business and industry for graduates to enter the work force.**

√ **Far too many students drop out or are forced out; attrition rates in some programs are very high.**

√ **Programs are often not organized and taught in a manner that can adequately respond to the diverse learning needs of many of today's students.** Today's technical education students are old, young, male, female, well prepared, not so well prepared, sometimes disadvantaged or handicapped. Their needs, learning styles, interests, background, preparation and basic skills vary far more than students did in previous years.

√ **There is not enough emphasis placed on actually "mastering" what is taught.** Often, low grades are averaged with higher grades and students can pass a series of courses with D's and C's and still graduate.

√ **Theory and practical application are often artificially separated.** In many post-secondary training programs, students take a course covering the theory of a certain aspect of the technology and they may not get the corresponding lab or practical application course in the same area until months later or in far too many cases not at all.

√ **Conventionally taught programs often fail to take advantage of what recent research tells us concerning how people learn best.** Educational research during the past twenty years has shown quite clearly that trainees can learn much more, learn it easier and quicker and remember it longer when critical elements of the teaching-learning process are handled differently than we usually do in the more traditional approach.

√ **When the instructor leaves, the curriculum often leaves with him/her.** In the traditional approach we rely far too much on instructors to have everything in their heads. CBE forces us to get organized and to get things documented on paper.

√ **Students are often bored by lengthy lectures, too much theory, not enough practical application and lengthy reading and writing assignments of questionable value.**

The competency-based approach is simply a tool to help vocational and technical educators make good programs better. It makes the operation of training programs more systematic. It forces instructors to be organized. It encourages students to be more responsible. It allows us to put into practice what we have learned recently about how people learn best. CBE is not perfect. It will not solve all of our problems and it is not a guaranteed success for every student but it has been proven to be a very effective enhancement to the traditional delivery approach.

What Principles and Assumptions Underlie the Competency-Based Approach

A-2

It is important that vocational technical educators who are exploring CBE fully understand the basic assumptions, principles and educational philosophy that underlie this instructional delivery approach. In **Section A-2** we will examine some of the more important factors and take a brief look at what recent research tells us about each.

The following graphic illustrates assumptions that underlie the competency-based approach.

Factors	Research
Students usually perform to the level of expectation set by their instructors.	One of the basic philosophies behind CBE and other approaches to "mastery learning" is that students often perform to the level that we as teachers expect and require. Recent studies have shown this to be true. If we tell students we fully expect only a few to make A's and excel and we expect most to perform at an average level; students will respond accordingly. If we tell students the minimum acceptable level of performance is 70% proficiency; many students will consciously or subconsciously shoot for that level and aim no higher. If on the other hand we tell students up front that we fully expect and require that they attain each competency at a high level of proficiency (90-100%) and then help them attain it; far more students will reach higher levels of mastery.
The primary reason students fail to learn a given unit of instruction well in school is because they failed to adequately master a prerequisite unit or units of instruction.	This is the foundation of the competency-based mastery oriented approach to education and training. Study after study has shown that when students fail to fully master a unit of learning; they have great difficulty mastering subsequent units of learning for which that unit is a prerequisite. CBE tells us that the greatest assistance we can give the student in mastering competency No. 2 is to help and require the student to master (not just "pass") competency No. 1! This is especially critical in most vocational-technical programs where many of the competencies build upon each other.

Factors	Research
It is much easier to bring about and then evaluate mastery of a learning outcome if the student and the instructor clearly understand what it is the student is to master.	Studies have shown that a student's chances of mastering a learning outcome increase simply by clearly communicating to students exactly what it is they are to master. This is why CBE relies so heavily on precisely stated competency statements and precisely stated objectives for each competency.
Most students can master most learning tasks to a high degree of proficiency if given sufficient time to learn and high quality appropriate learning material.	This, of course is the central theme of the mastery learning movement which has been adopted by many schools and school systems. Research is showing very clearly that when provided with these two key ingredients (time, appropriate resources) virtually anybody can learn virtually anything they want to learn. It is important to realize that CBE with its competencies, learning packages, media and related components is simply a means of providing these two essential elements.
Shifting away from instructor centered teaching to an approach of helping students learn requires major changes in the way we organize, deliver and manage the entire teaching/ learning process.	One of the major philosophical differences between the competency-based and the traditional approach is where the focus is. In CBE the focus is squarely on helping the student learn rather than simply teaching. In CBE we establish student mastery of competencies as the goal and constantly adjust media, methods, techniques and curriculum materials to come closer and closer to meeting that goal.

Factors	Research
The time it takes a student to learn a task and the number of attempts it takes a student to show mastery have little impact on how well the student can perform the task.	Although a little hard to believe at first, studies conducted recently are showing that learning time and the number of test attempts have little bearing on how well a student can perform a task. What seems to be critical to later performance is how well they were required to perform the task to show mastery.
Perhaps the most significant aspect we can accomplish to improve student attitudes in school is to help them be successful learners.	Again, recent research is showing dramatically that a student's attitude to the subject, the school, education in general and self are highly influenced by the degree of success or failure experienced in school.

When Can a Program Call Itself Competency-Based?

A-3

Obviously, the competency-based approach will not look the same in different settings.

Factors that dictate differences in the way CBE is operationalized at the classroom level include:

	Factors
The nature of the program or course	-Is it academic or vocational; is it skill oriented or knowledge oriented; is it basic or advanced?
The setting	-Is it in a high school, community college, technical institute, industrial training, etc?
Length	-Is it a short term course or a two year associate degree program?
Autonomy	-Does the course or program stand alone or is it simply a small part of a larger program?
History	-Is it brand new or is it perhaps an attempt to revise or improve an existing offering?
How do students enter	-Do they show up as a group once or twice a year or do they come and go throughout the school or calendar year?
Size	-Is it a one instructor program or a large department?

Keep in mind that regardless of the setting in which CBE is being implemented; the three basic elements described earlier should always be included. Again, CBE is:

√ **based on precisely stated, industry validated competencies,**

√ **organizes and delivers instruction focusing on the learning needs of the individual, and**

√ **evaluates students on their ability to demonstrate mastery of the competencies.**

The first and third elements (competency-based and performance oriented) are somewhat easier to include in a CBE program--regardless of the level, nature or setting of the program--than the second element (focusing learning on the needs of the individual).

What will differ at the local level will be many of the related and desirable elements and characteristics often associated with competency-based learning. These include open entry, open exit, time flexibility, self-pacing, modularizing of instruction, degree of mediation, and other related factors. The graphic on pages 16-19 is an outline of the essential and many of the related or desirable characteristics of CBE as they relate to successful realization of the ultimate goal of CBE, **helping students master to a high degree the competencies included in a training program.**

ESSENTIAL CHARACTERISTICS OF CBE

Characteristic:	Role It Plays in Realizing the Potential Benefits of CBE:	Considerations for Implementation at the Local Level:
1. A CBE program is based on clearly stated industry validated competencies.	1. Helps everyone concerned know exactly what is to be learned. Aids in objective grading and evaluation, granting credit for previous learning, articulation and transfer. Helps greatly in organizing the curriculum around the procedures or tasks students will actually be performing on the job.	√ Make sure competencies are industry validated √ List them on an official document and give students a copy √ Examine the competencies annually for needed changes √ It is best to ignore your existing courses for now, identify competencies performed on the job and then see how they might fit into courses √ The ideal is to have 90-100% of the program competencies "hands-on" skills, procedures, etc.
2. Instruction is delivered to the extent practical in a manner that maximizes learning outcomes for each student.	2. Absolutely essential if you want to reap the proven benefits of CBE: higher levels of mastery, more efficient learning, better retention and more positive student attitudes. Research shows that different people learn at different rates using different methods, media and approaches. Delivering instruction to an entire group at once greatly reduces the benefits of CBE.	√ Although there are effective strategies in use where "mastery learning" can be realized in a fixed-time, group-paced setting, such approaches are very difficult to use in an occupational setting where students need to enter at different times throughout the year. In such settings, most of the routine instruction should be aimed at the individual student. Individual students can learn in a small or large group-as long as their individual learning needs are being met.

3. Students are graded and evaluated based on their mastery of competencies.	3. The key phrase here is "mastery of competencies." To reap the benefits of CBE, nothing less than "mastery" should be accepted. That doesn't mean perfection-it does mean that students should show proficiency over 90-100% of the objective criteria used to evaluate each competency (knowledge or skill).	√ A CBE program will be only as good as the tests used to evaluate mastery of the competencies. √ Some competencies will need a "performance test", others will need a "knowledge test", and others may need both. Since most of the competencies should be hands-on skills, most of the tests should be performance tests.
RELATED AND DESIRABLE CHARACTERISTICS ASSOCIATED WITH CBE:		
4. Open-entry	4. When students can enter monthly, bi-weekly or weekly the average enrollment throughout the year remains consistent.	√ Open entry is not absolutely essential to implement CBE. It is however very helpful in serving students. √ Programs operating 11-12 months a year might allow entry at various dates throughout the year. Programs operating only 9 months might allow entry at dates throughout the first 4-6 months. √ The only way instructors can meet the learning needs of students in an open entry setting is to have high quality, packaged, mediated student learning materials so students can have the learning materials they need when they need them.
5. Open-exit	5. Open exit allows students to complete the program when they have successfully completed the program competencies. It results in graduates entering the job market at random times throughout the year rather than flooding the job market in December and June.	√ Open entry and open-exit, of course, are tied closely together. √ Open exit will require some changes in the system such as course completion dates, final exams, etc.

6. Self-pacing	6. At the post-secondary level self-pacing is highly desirable. Students can best determine when the pace of instruction is too fast or too slow. Allowing students to pace themselves (with instructor advice) through the program forces them to become more responsible for their own learning.	√ Self-pacing like open-entry requires a largely self-instructional curriculum such as learning packages supported by media. √ Even at the post-secondary level instructors in self-paced programs often impose standards of progress that require a certain minimum number of competencies be completed during a month, term, semester etc. Students pace themselves from competency to competency as they demonstrate mastery of each.
7. Modularized packaged instruction	7. The use of learning packages, learning guides, modules and similar approaches has proven to be the most practical means of providing students with the two key ingredients required for mastery learning: (a) high quality instruction and (b) sufficient time to learn.	√ The most common approach is to develop "learning guides" which simply guide the student through the carefully structured use of a variety of existing learning resources such as books, tapes, slides, discussions, etc. √ Writing completely self-contained "modules" is extremely expensive and time consuming and results in small "encyclopedias" that rely too much on the students ability to read and rarely get updated.
8. Individualized instruction	8. Since the goal of CBE is to maximize learning for each individual student, instructional decisions should be made at the individual student level rather than at the class level.	√ **Individualized instruction does not mean individual instruction.** Individuals can learn very effectively (and often prefer to) with a partner, on a team and occassionally as part of a large group. As long as instructional decisions are based on meeting the learning needs of the individual student, instruction is individualized.

9. Time-flexible	9. Research in mastery learning tells us that different students sometimes need different amounts of time to master a given task. Using time flexible strategies can provide this extra time some students need. This concept also allows more able students to move ahead at a faster rate.	√ You may still want to require minimum number of competencies be completed during a given grading period but allow flexible time on each competency. √ The time gap between slower and faster learning students is wide at first and decreases as students progress through the program.

Has CBE Proven Itself Effective?

A-4

CBE and related approaches are in widespread use throughout public and private education, business, industry and the military. The following is a brief representative look at competency-based approaches that have been successfully implemented in various settings.

Setting	Approach
Wascana Institute, Regina Saskatchewan, Canada	A large post-secondary institution in which each CBE program is based on clearly stated competencies (which, by the way, are published in Wascana's official school bulletin rather than courses). For each competency, a carefully designed, mediated "Student Learning Guide" was developed. Students enroll in a program when vacancies occur and exit when they complete all required competencies. Students exit with a competency transcript rather than a traditional grade transcript.
Texas State Technical Institute, Amarillo, Texas	Part of the TSTI-System, TSTI-Amarillo is in the early stages of implementing CBE throughout all of its technical programs. For each program a task listing has been developed and several hundred student learning guides have already been written.
Chicago Mastery Learning Reading Program. Chicago, Illinois	A highly successful program in which mastery learning has been successfully implemented in a group oriented, instructor directed and fixed time system. A group oriented approach to CBE has been implemented in over 50 schools throughout the Chicago area involving thousands of students. Outcomes of the effort include an increased rate of learning, reduction in the variation of learning outcomes among students and highly favorable attitudes among students and teachers.
American Red Cross CPR & First Aid Course	A two day short course was compressed into one day when it was shifted to a competency-based format (precise outcomes, mediated packaged learning materials). Results include raising the average final written test score substantially and raising the lowest score made on the same test dramatically.

<table>
<tr><th>Setting</th><th>Approach</th></tr>
<tr><td>Electronic/ Electricity Training Program, U.S. Navy</td><td>After a detailed analysis of training costs in three different formats of an electronics course, the following results were published:
<table>
<tr><th>FORMAT</th><th>TOTAL COST PER COURSE HOUR</th></tr>
<tr><td>Conventional</td><td>$111.79</td></tr>
<tr><td>CBE</td><td>$64.48</td></tr>
<tr><td>Mixed</td><td>$96.64</td></tr>
</table></td></tr>
<tr><td>Washington, DC Police Academy</td><td>Using a competency-based, time flexible format, a traditional 16 week recruit training program was reduced to an average time of 12 weeks (range was 5-16 weeks) with fewer trainees "washing out" and instructors reporting more time to spend with individual trainees.</td></tr>
<tr><td>AT&T Long Lines Maintenance Course</td><td>Shifting to a modularized, self-paced format saved an average of two weeks training time per trainee ($4 million savings annually) and improved job performance.</td></tr>
<tr><td>Northeast Metro Technical Institute (formerly 916 AVTI) White Bear Lake, MN</td><td>This large post-secondary center serves the disadvantaged, handicapped, chemically dependent, the incarcerated as well as regular students. After operating a CBE system for over 10 years in which new students enroll when a vacancy occurs and graduation is held every Friday, they report that vandalism is virtually nonexistent. Hundreds of student-months of training are saved and the average cost per student for training is near the state average for vocational centers.</td></tr>
<tr><td>Florida State University, Curriculum of Attainments</td><td>This nontraditional bachelor's degree program includes majors in fields as diverse as nursing, biology and philosophy. In each major, "attainments" are clearly identified, self-paced learning activities are employed and each attainment is evaluated by a jury.</td></tr>
</table>

The preceeding list was certainly not intended to be an exhaustive study of CBE success stories. It was rather a glimpse at the wide diversity of settings in which competency-based approaches have been successfully implemented.

What are the Advantages of Competency Based Education? A-5

Some of the advantages of developing and implementing a competency-based approach to education and training include:

Advantages of CBE

1. Everyone (yes, even the student) knows exactly what it is trainees are expected to learn.

2. Everyone knows up front precisely how well the student must perform each competency to reach mastery.

3. Students compete against a predetermined mastery level and not against each other; cooperation-not competition among students is fostered.

4. By selecting specific competencies training can be tailor made to the needs of individuals.

5. By having outcomes written down in black and white and open to public scrutiny we can become more "accountable" to the taxpaying public.

6. Students master one competency well before being forced or allowed to move on to the next thus providing them with the crucial prerequisites they need to master later competencies.

7. By being required and helped to master early competencies at a high level of proficiency students usually develop a more positive attitude about themselves and the training program.

8. Well developed CBE programs treat students with more respect and dignity than most traditional programs do.

9. Students can demonstrate mastery of, get full credit for and skip instruction in those competencies which they attained through prior learning or experience.

10. Articulation and transfer vertically and horizontally are greatly facilitated by each program focusing on precisely stated competencies instead of vaguely defined course descriptions.

11. When the focus of testing is on performance as it is in CBE, students enter the world of work competent and confident in the skills they will be doing on a daily basis.

12. Theory and practical application are tied closely together when CBE is appropriately designed and delivered.

13. Average enrollment can be kept more constant since CBE provides for the possibility of open entry. New students can enroll when vacancies occur.

14. Likewise, since CBE provides for the possibility of open exit, students can exit when ready avoiding the "dumping" of many graduates on the job market at the same time.

15. In CBE, the whole system is far more organized, systematic, and documented.

16. CBE can meet the unique needs of individuals and, after all, that is what we are really here for-to serve the customer. CBE allows students to enter when there are vacancies, get credit for prior learning, know clearly up front what is expected, learn using a variety of activities and materials, no longer have to keep up with the groups, have sufficient practice before being tested and get daily feedback on how well they are learning.

Of course, no system or approach is perfect. CBE is not without its shortcomings. Among the disadvantages of implementing the competency-based approach are:

Disadvantages of CBE

1. It takes a substantial amount of commitment, foresight, energy, effort and leadership to get started and keep going--especially when things get rough.

2. The "system" rarely provides for the up front development time and funding necessary to adequately design a CBE system, develop learning materials and media and train staff.

3. It is fairly complex. One of the strengths of CBE is that it effects all aspects of a program's operation from curriculum to media to grading to facility layout. The down side of this complexity is that few individuals are competent and experienced in putting all these pieces together.

4. So many things can go wrong. For CBE to be successfully installed, all pieces of the puzzle must be developed and then maintained. If one or more components break down, the CBE effort often fails.

5. The role change instructors experience in shifting from traditional to competency-based is often traumatic: so traumatic in fact, that some instructors cannot seem to make the jump.

6. Some vocational educators just are not prepared to expend the substantial time and energy to implement competency-based instruction.

7. Instructors often find themselves wanting to implement CBE but do not have the time to develop learning packages, generate competency statements and all the other CBE things that need to get done. Often, installing CBE becomes a second full-time job on top of the instructor's primary job of teaching.

8. Far too many times, administrators, supervisors and others in leadership positions simply do not understand the nuts and bolts of CBE development and implementation. Often, administrators will say "yes, we are for it and we are going to do it" yet they may refuse to release a typist, give instructors time off to write or provide adequate staff development and support.

9. It is difficult to fit CBE into the present system of education and training. It is not uncommon to see well conceived and adequately developed CBE programs ultimately fail simply because the registrar refused to budge from twice yearly admissions or blocked attempts to allow students to register for a new course when they complete the competencies in their present course.

10. Everything seems to support the status quo and discourages or even penalizes experimentation or innovation. Everything from funding formulas to faculty promotion policies often seems to broadcast the message "Do not change, do not be different-even if it benefits the student!"

Competency-Based Education Program Development Steps

A-6

The preceding information reviewed the competency-based approach-what it is, underlying principles, settings in which it is found and advantages and disadvantages. The next section takes a more concrete look at CBE-specifically, what major steps might instructors or administrators at the local level take to actually get a competency-based program or programs underway.

Certainly, there is no one "right" list of components, elements, or steps required for the CBE development process. Different school districts, institutions, states, instructors, and curriculum developers have approached the CBE development process differently. The major steps involved, however, are similar. The seven steps described in this section cover the critical program development activities that CBE practitioners find themselves engaged in as they design, develop and implement CBE programs and courses.

These seven program development steps will be discussed in greater detail in the following components.

Major CBE Program Development Steps	Component
1. Determine overall design of CBE system of learning.	B
2. Define program scope, job titles included and student characteristics.	B
3. Identify and validate student competencies.	B
4. Develop student learning materials.	C
5. Organize the physical facility for CBE.	D
6. Develop CBE management system.	D
7. Develop and follow a CBE implementation plan.	D

A-6

The following graphic provides a brief description of the typical process of implementing competency-based education. Other components in the Resource Guide will explain implementation steps in greater detail.

CBE Program Development Step	Purpose	Examples/ Comments/Etc.	Sources of Information Data, Input, Etc.
1. Determine overall design of CBE system of learning.	1. Describes exactly what the CBE system is to look like. Typically developed as a flow chart which depicts students learning sequence as well as a narrative description of the degree to which program will be open entry, open-exit, self-paced, individualized, modularized, etc. This step is especially important if several programs are being developed at the same school or site.	1. a) Instructional flow chart would include key events from which student beginning instruction in a competency to showing mastery. b) (Hypothetical Data Processing Program will be used as an example in this column.) Data Processing Program will be highly individualized although the student may decide to work alone or with others. Group will be brought together at least twice each week for 1-2 hours. New students may enroll monthly and exit at any time. Students will determine pace with instructor setting minimum acceptable progress. Modules and media will be primary vehicle for presenting information, etc.	1. Similar programs, outside consultants, reference books on instructional design, etc.
2. Define program scope, job titles included and student characteristics.	2. Helps nail down the real intent, focus and parameters of the program and provides information about typical entering students.	2. Data Processing: Program is designed to prepare students with the knowledge and skills needed to enter and advance in the data processing field. Major goal is occupational proficiency rather than personal interest.	2. a) Role, scope, mission, etc. of program, existing course description, state dept. and local school documents, advisory committee, etc.

2.(continued)		Students may specialize in (1) Data Entry, (2) Computer Operations, (3) Programming, or (4) overall proficiency in all three. Typical students hold a high school diploma or GED and possess moderate capabilities. An increasing number of students are disadvantaged and/or physically handicapped.	b) Student characteristics, guidance and counseling personnel, brief screening instrument, admission form, etc.
3. Identify and validate student competencies.	3. Results in a document which becomes the official list of outcomes upon which the program is based and which students master (often called Task Listing, Competency Profile, etc.)	3. Sample competencies/tasks from Data Processing might include: √ Debug a program √ Enter numerical data from keyboard √ Run batch data √ Format computer printout	3. Formal analysis of the occupation; DACUM PROCESS, VTECS Catalog, task listings developed elsewhere, existing curriculum materials, instructor input, advisory committee, etc.
4. Develop student learning materials.	4. The real heart of the CBE program: the student learning material to be used by students on a day-to-day basis to master each competency (often called modules, learning packages, etc.)	4. The approach to student learning materials developed for a competency based data processing program might focus on the development of a separate learning package or module for each task supported by a textbook, workbook, instructor checkpoints, hands-on activities, and mastery tests.	4. Commercially available books, slides, tapes, manuals, magazines, workbooks, journals, games, equipment, instructor developed activity sheets, handouts, quizzes, modules developed by other schools, districts, states, etc.

5. Organize the physical facility for CBE.	5. Focuses on rearranging the physical facility based on students mastering the tasks on the program task listing.	5. Switching from the more traditional to competency-based approach for data processing might involve elimination of separate classroom previously used for "theory," setting up of practice or work stations for each type of computer, peripheral, etc., use of testing areas and setting aside areas for storage of modules, media and support materials.	5. Visit other CBE programs especially in same occupational field, consultants.
6. Develop CBE management system.	6. Involves the design and development of an overall support structure in which the CBE program can function on a daily basis.	6. Typical CBE management documents, forms, procedures, etc. developed for a Data Processing Program might include: a) Student orientation materials b) CBE grading system and forms c) Procedures for teaching each student's daily, weekly or monthly program. d) Competency profile	6. CBE reference materials: other CBE schools and programs, outside consultants, adapting existing management forms.
7. Develop and follow a CBE implementation plan.	7. Describes in detail what will be done, who will do, when it should begin and end, how much it will cost and any other important information about how CBE will begin, be phased in, operated, evaluated, etc.	7. Implementation plan for a Data Processing Program might describe in detail what will happen during the first six months to two years as well as any major milestones after that.	7. Reference material on program design and development, other CBE schools and programs, consultants.

Each component of this manual includes a resource section. Resource Section A-contains information on how other schools and organizations define and conceptualize competency-based education.

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Individualized Competency-Based Education

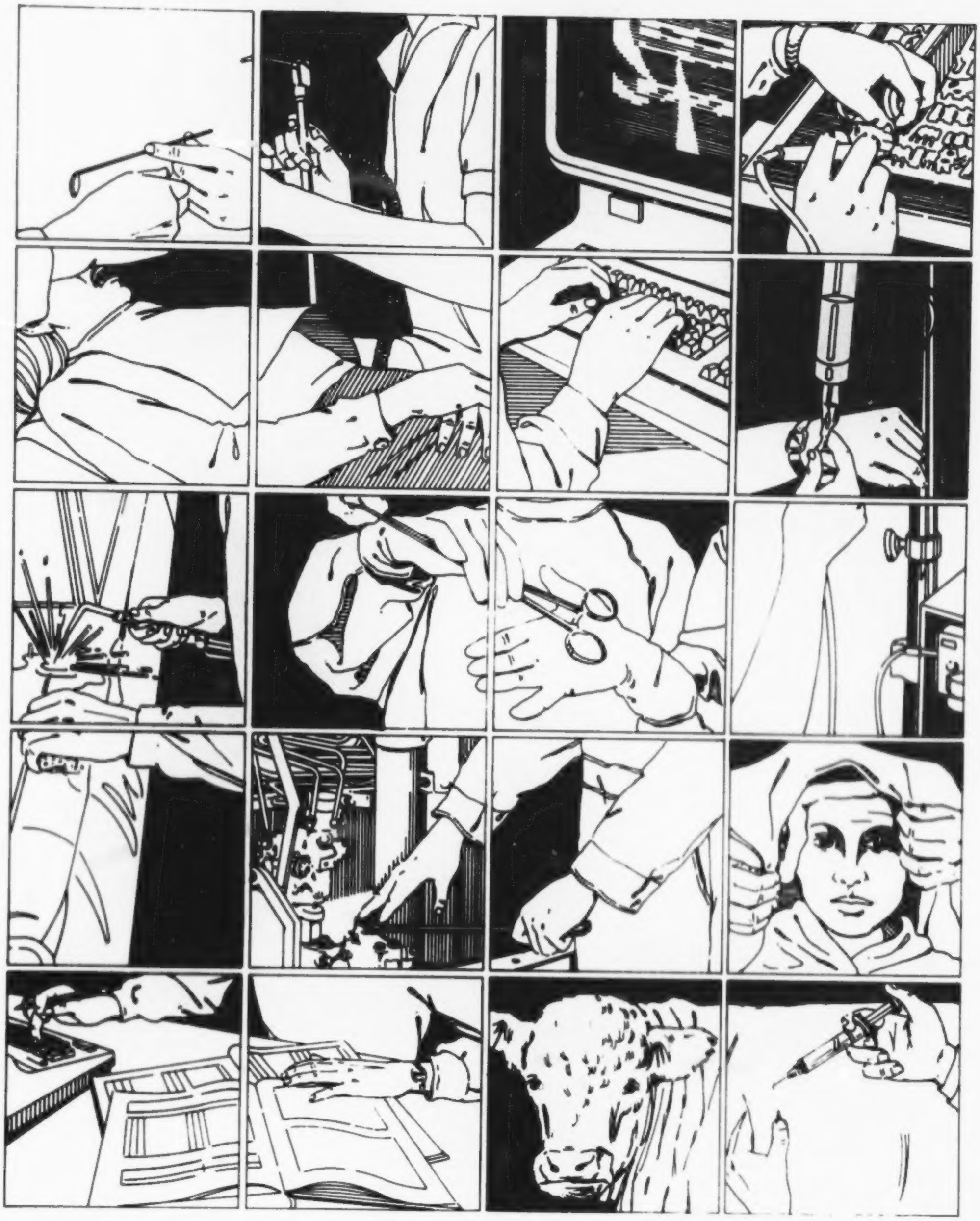
Wascana Institute

Wascana Institute is a comprehensive vocational technical school located in Regina, Saskatchewan. It is recognized as a leader in CBE development. The following resource is a copy of a pamphlet that describes Wascana's philosophy regarding individualized competency-based education.

**Saskatchewan
Advanced
Education and
Manpower**

Wascana Institute

Individualized Competency-Based Vocational Education



What is competency-based education?

Competency-based education as applied in Wascana Institute, can be defined as training for employment that is based on demonstrated performance of current job tasks under specified conditions and according to prescribed standards. It is the goal of competency-based education (CBE) to help every learner acquire the competencies needed on the job, and since individuals differ in the ways they learn best, instruction should be tailored to the individual student's abilities, learning styles and career goals.

What is individualized instruction?

Although many aspects of competency-based education can be incorporated within a traditional, group oriented program, an individualized learning system is optimally suited to CBE. Although the two approaches — competency-based education and individualized instruction — are not equivalent or necessarily interdependent, they are linked in this discussion, as in practice, because individualized instruction is the most appropriate method of delivering competency-based education.

Individualized instruction is distinguished by its concentration on meeting the needs of the individual student. Recognizing that students enter a program with different abilities, interests and experiences, and that they learn at different rates and in different ways, the instructor of an individualized program seeks to respond to the specific learning needs of each student. Some students may require little help, and progress through the program very quickly. Others may encounter more difficulty and require remedial assistance as they progress through the program. Students may also have some choice in the type of learning activities which best suit their individual learning styles. Some may rely heavily on reading while others may prefer a more audio-visual approach. In addition to providing some flexibility in the amount of time required for training and the type of learning activities preferred by various students, an individualized program should also provide students with some flexibility in the choice of program content. Students should be able to select content appropriate to their personal needs or ambitions. However, it must be recognized that in many occupations the minimum standards and basic curricula are defined by an accrediting or licensing body.

Individualized instruction does not preclude the use of group instruction — such as the use of films, lectures, demonstrations, or field trips — in situations where it is advantageous for scheduling facilities or for enhancing student motivation. Unless a class is exceptionally homogeneous, however, one would not generally expect the whole group to be involved in the same learning activity at the same time.

What is individualized competency-based education in Wascana Institute?

An individualized competency-based program is a systematic approach to vocational education. It focuses on the following features:

One — The instructional content of the program is based on industry's analysis of the tasks performed on the job. (In more traditional programs, curricula have been designed around broad topical areas rather than specific jobs tasks.)

Two — The standards used for evaluating student performance are determined by industry in the province. (In many traditional programs the performance of each student is judged against the performance of other students in the class.) In individualized competency-based programs the specified standard by which competency is determined does not vary, with the result that student evaluation becomes more objective.

Three — Each task to be performed, the conditions under which the student must perform, and the required standards of performance are explicitly defined in writing, for the student (and to any other interested persons) before instruction. This information is clearly spelled out in a statement called a "performance objective". (This, too, contrasts with established approaches, in which the final learning outcomes and the methods of evaluating student learning are commonly considered information solely for instructors.)

Four — The selection of content and the regulating of student progress are based on the instructional needs of the individual student. Ways of meeting those needs are determined by an assessment of the student's aptitudes, learning styles and career goals (how far up a particular career ladder the student aspires to go). Therefore, at any one time, different students will be working on different objectives. (In traditional programs all students are expected to study the same content, use the same materials, and spend the same amount of time on each part of the course.) In individualized competency-based programs, both the amount of time spent in attaining competencies and the choice of learning activities vary among students. However, the standards by which competence is determined is established by industry, and does not vary among students.

Five — Each student is expected to acquire the necessary knowledge and skills to demonstrate, through performance of each task, that he (she) has reached the specified standard of performance. In other words, students must demonstrate mastery of all parts of the program. A general, average assessment or final mark **is not** given for the whole program. Rather, competence is demanded in each and every portion of the course.

Six — Recognition is given to students who can demonstrate mastery of some of the program at the time they enrol. If an individual has acquired some of the skills and knowledge contained in the program through previous training or work experience, then he (she) can take what is known as a "challenge test" in those particular parts of the program. If the student can successfully demonstrate the stardard of performance prescribed in the program, the indivdual is awarded credit for those particular parts of the course and does not have to study them any further. (In traditional group-oriented instruction, all students must cover the same material, regardless of their previous training or experience.)

Why is individualized competency-based education being implemented in Wascana Institute?

The rationale for individualized CBE initiatives is based on the advantages offered, both during training and on the job. In the institute, increased effectiveness and efficiency in learning may be anticipated. Instruction is more directly focused on job-performance requirements. Since students receive individual attention to their learning needs, they do not have to keep pace with their classmates. Thus, a wide range of student abilities can be accommodated in a class without causing a detrimental affect on the pace of the more capable students. In other words, weak clients can be accommodated right along side of the outstanding achievers.

A major advantage of individualized CBE is the increased flexibility provided to students and employers. Individuals or groups of students may access a particular part of a program to up-date or up-grade specialized skills, whenever adequate training space can be arranged. Since students progress at their own rate, part-time learners can also be accommodated along with the full-time students.

Because each student's instructional program is based on his or her specific occupational goals, because each student knows in advance precisely what is expected, and because individual student differences are accommodated, the student is more highly motivated and his (her) efforts are more focused. Students take more responsibility for their own learning. And when students from competency-based programs join the work force, having met realistic and unvarying performance standards in their training, employers may confidently expect a more consistent quality of performance on the job.

How is a vocational program determined to be individualized and competency-based?

An individualized competency-based approach allows for flexibility and variation in its application. Individualized competency-based programs will vary, since teacher and student characteristics, available resources, legal and administrative constraints, program requirements, and support services differ from situation to situation. Because of its inherent flexibility, an individualized competency-based program can — through an evolving process of implementation — be achieved wherever there is sufficient commitment. Although details may vary, all fully individualized competency-based programs in Saskatchewan will share the following characteristics:

One — Instruction in a competency-based program is based solely on the knowledge and skills (competencies) needed for a student to be successful in a specific job. These competencies are identified by a task analysis conducted in close cooperation and consultation with industry. Periodic review ensures that competencies are valid and up to date. Thus, the tasks for which students are prepared are the tasks that workers currently employed in the job actually perform.

Two — Competencies are stated in such a way as to make objective assessment possible. Competencies are clusters of related tasks that workers perform on the job. Usually they are translated into performance objectives. Each objective specifies an observable and measurable task to be performed, the conditions under which the student will perform the task, and the standard for acceptable performance. In order to help focus the learning activities, the entire competency statement, including task, conditions, and standard, is made known to the student before instruction.

Three — Every learning activity is designed to prepare the student to attain a competency — that is, to do a specific task under specified conditions and at a special performance level.

Four — The conditions of performance and the assessment standards are derived from the nature of the competency. In other words, a student demonstrates a skill competency by performing it rather than by writing about it. Both instruction and evaluation simulate actual job situations as nearly as possible. Performance in a realistic setting is the most valid method of demonstrating competence. Further, the performance standard is based on realistic job standards.

Five — The student's progress through an individualized competency-based program is determined by the demonstration of competencies rather than by the passage of an arbitrary number of hours or other period of time. Both pacing and the choice of learning strategies are determined by the student, ideally as a result of teacher and/or counselor assistance.

Six — Completion of study occurs when the student attains all the selected competencies outlined in an individual plan of study. When the student leaves the program for any reason, regardless of his or her status in relation to declared educational goals, he (she) is given a record of competencies attained in the program.

A major effort to implement competency-based vocational education is underway in Wascana Institute. The focus of this movement is on providing each learner with the specific knowledge and skills needed to obtain and hold a job in the field of his or her choice. Saskatchewan Department of Advanced Education and Manpower endorses the principles and procedures of individualized competency-based vocational education as described in this position paper.

Wascana Institute competency-based programs

Program	Starting Date
Word Processing Certificate *	Fall 1983
Telecommunication Technician *	Fall 1984
Business Programmer	Fall 1984
Drywall Construction	Fall 1984
Painting and Decorating *	Fall 1984
Graphic Arts	Fall 1984
Welding	Fall 1984
Machine Shop	Fall 1984
MVMR	Fall 1984
Autobody	Fall 1984
Barbering and Hairstyling	Fall 1984
Cosmetology	Fall 1984
Plumbing and Pipefitting	Fall 1984
Carpentry	Fall 1984
Drafting Technician	Fall 1984
Appliance Servicing	Fall 1984
Horticulture and Landscape	Fall 1984
Retailing (tentative)	Fall 1985
Personnel/Industrial Relations	Fall 1984
Short Order Cooking	Fall 1984
Urban/Rural Planning (tentative)	Fall 1985
Property Management (tentative)	Fall 1985
Travel and Tourism (tentative)	Fall 1984
Secretarial Studies *	Fall 1984
Pesticide Applicator	Fall 1984
Trades Introduction	Fall 1984
Recreation Vehicle Repair and Maintenance	Fall 1984

* Existing Programs to be converted to a competency-based delivery system.

What is Competency-Based Vocational Education (CBVE)?

Competency-Based Individualized
Vocational Education Consortium
(CIVEC), Addison, Illinois

The Competency-Based Individualized Vocational Educational Consortium (CIVEC) has produced a series of self instructional competency-based professional teacher training manuals using an individualized format. This series is excellent and covers a variety of areas regarding the implementation of CBE. The following resource is contained in the first learning guide of this series and provides a thorough definition of competency-based education. For further information concerning this teacher training series contact: CIVEC, 301 N. Swift Road, Addison, Illinois 60101 312/620-8770.

INFORMATION SHEET

001-001-001

What is Competency-Based Vocational Education (CBVE)?

Competency-based vocational education (CBVE) is a systematic approach aimed at improving the teaching/learning process. CBVE has also been called competency-based instruction (CBI), performance-based education or instruction, criterion-referenced instruction (CRI), mastery learning, proficiency-based education, objective-referenced learning and competency-based education (CBE). By definition, CBVE refers to a system whereby tasks of workers are identified and validated via a current advisory committee or workers on the job. Performance objectives are written and given to students prior to instruction. Instruction is centered around performance objectives. Criterion-referenced objective evaluation measures are used to evaluate performance. The programs can be open entry/open exit, and students master a given task before progressing to the next task.

A "competency" is defined as a knowledge, skill, attitude, judgment or task which the student will demonstrate at a predetermined level. Competency statements begin with an action verb and contain a noun. Examples are: replace brake shoes, bake a cake, identify lawn weeds, type a business letter, and make an occupied bed.

The basic intent of CBVE is to aid student mastery of required competencies needed for successful on-the-job performance. Students must perform. They cannot slide by with a "C" or "D" average with only marginal competency.

INFORMATION SHEET

001-001-003

Essential Components of a CBVE Program

1. Tasks to be achieved are:

   A. Measurable - They begin with an action verb, describe what is to be done, and may contain a qualifier.

      Example: Bake a layer cake; remove and replace brake shoes; type a business letter in modified block style.

   B. Based upon actual worker's tasks - The curriculum in a CBVE program is derived from what workers do on the job in a given occupation. It is recommended that V-TECS catalogs be used as a curriculum starting point. For new and emerging occupations, the tasks will be those expected to be performed by workers and verified by a jury of experts.

   C. Validated by representatives of business and industry - The task list generated from workers' tasks must be verified or validated (localized) by experts in the field. This can be done by workers or by the specialized occupational advisory committee. Survey results or advisory committee minutes should reveal this verification. The tasks should have been rated and not just approved by vote; i.e., not just rubber stamped.

   D. Made public in advance of instruction - The task lists or curriculum must be shown to or given to the students and everyone else who may be interested in the program prior to the beginning of instruction. This eliminates the guesswork as to what is going to be taught.

   E. Updated annually - The task list must be updated annually; i.e., reverified by industry experts.

DEPT.	PROG	TASK	TPO	MPO
	PTT	001	001	001

2. Performance objectives are written for each task - Performance objectives inform the student what must be done to accomplish each task and guide the teacher in designing appropriate teaching and learning activities.

3. Each performance objective:

   A. States the actual conditions under which each task will be performed for evaluation.

   Examples are: - Given a recipe, baking supplies and equipment; Using an electronic typewriter; Provided with an outboard engine.

   The conditions statement should never contain teaching/learning activities or describe what the teacher will be doing.

   B. Contains explicitly stated criteria and standards for evaluation. The performance objective should refer to written exams and product/performance checklists. Explicitly stated criteria eliminates the guessing game as to which elements of a program are essential and which are not. Student performance is measured against these standards and not other students.

   C. Contains a restatement of the task - One-third of an objective is an exact repeat of the task statement from the task list.

   D. Is made public in advance of instruction - The performance objectives should be available to students and all concerned individuals prior to instruction.

   An example of a good performance objective is:

(Condition)	Given:	A recipe, baking supplies, and equipment
(Task Statement)	You Will:	Bake a layer cake
(Criteria)	How Well:	You must score 8 out of 10 on a written exam and also receive 9 out of 10 on a product checklist to master this task.

4. An instructional delivery system is used that:

A. Promotes individualized programs for each student - Each student should be given the opportunity to master the tasks commensurate to his or her interests and abilities. This does not mean that a student must be allowed to complete only the tasks of interest and still receive an associate degree from a community college. It means that the opportunity must be available to students to choose that which they want to learn and or are able to learn.

B. Provides immediate and frequent feedback - Constant and immediate feedback are important aspects of a CBVE program. Students complete self-checks for feedback. Teacher feedback is given during and upon completion of each task. Students no longer have to wait until a unit test is given for feedback. Should a student fail to master a task or need remediation, it can be given immediately. The student may be asked to review a slide tape or video presentation, work with another student, or complete a smaller aspect of the task before attempting the entire task again.

C. Provides flexibility - In a CBVE system of instruction, students progress at their own pace. They do not move on to a new task until they master the task presently being learned. Thus, learning is not time bound.

D. Allows students to proceed at their own rate - In order for CBVE programs to be truly effective, students must be allowed to proceed at their own rate. In order to accomplish this, some community colleges have added some open labs each week to allow slow students the extra time needed or to allow the fast student the time to excell. This element does not rule out teacher pacing as 70 percent of the vocational students desire student pacing while 30-35 percent need to be paced but at their own rate of learning.

E. Requires students to demonstrate mastery of each task - "To learn by doing" has always been a strong point of vocational-technical education. Emphasis is on performance and task completion. Paper and pencil tests are downplayed while performance is highlighted. In many CBVE schools, objective written tests or oral tests are given only to see if the student has the necessary cognitive information to perform a task.

In a CBVE program, each student is individually evaluated on each task. Each student is encouraged to master as many tasks as possible and to the highest possible level.

Some students exiting a program will be able to only perform a minimum number of tasks to a minimal level. They may need a lot of supervision on the job. Others will exit a program being able to perform many tasks on the job with minimal supervision. Still others may exit the program with the ability to teach others to perform tasks.

5. Criterion-referenced measures are used to evaluate attainment of performance objectives and:

A. Emphasis is on actual task performance - Students must complete real tasks in an environment and using equipment as close to the real world as possible.

B. Checklists with prestated standards are used to objectively evaluate students - One of the most critical aspects of ensuring objectivity and of determining whether students are competent is the use of product/performance checklists. There should be one checklist for each psychomotor task. These should be available to the students while they are learning the tasks. The checklists should contain the standards and a yes-no or acceptable-unacceptable two-column rating system. Rating scales are unacceptable. An abbreviated example would be:

PRODUCT CHECKLIST

Task No. 090 Type a Letter of Application

Items to be Observed or Checked	Rating	
	Yes	No
1. Free of grammar errors	___	___
2. Free of punctuation errors	___	___
3. Corrected all typing errors neatly	___	___
4. Free of spelling errors	___	___
5. Typed a signature	___	___

C. Written exams are used, but only to ascertain cognitive knowledge. In a CBVE environment, the emphasis is on performance - not paper and pencil tests.

Desirable Components of a CBVE Program

The following are desirable components of competency-based vocational education programs.

6. Student learning is "real world" oriented. The entire orientation of the program is upon tasks performed by workers in the "real world". In some schools, students perform just as they would in industry. They help run real businesses such as a beauty shop, flower shop, restaurant, automotive shop, or body shop. They perform tasks under the supervision of the instructor/supervisor. Grades are their "pay".

7. Instruction is personalized. For over 100 years, many instructors have been giving "lip service" to the research which shows that each student is different. For instance, some students learn by seeing, some by hearing, some by tactile

experiences (feeling), and others by a combination of these. There are many other differences about students. In addition, the ability levels of students are quite varied.

In order to meet the needs, interests, and ability levels of students, a personalized plan of learning should be developed for each one. Since no two students learn in exactly the same way, a separate learning plan is needed for each. In a personalized system of instruction, instructors strive to make time the variable and learning the constant. The tasks to be learned by each student are identified, and each pursues his or her own learning plan. In a traditional system of instruction, all students would pursue the same path. In CBVE, some students in a program may wish to become an automotive mechanic, while others may wish to be carburetor or transmission specialists. Regardless of the level of each student, a personalized plan can be identified.

In addition, the speed of learning is student paced. Each can learn at a pace which is comfortable. Caution must be used here though since 30-35 percent of the students cannot self-pace themselves. The personalized plan must include due dates to assure progress. As much as possible, the learning activities and resources should be geared to the student's learning style and needs.

8. The student and the teacher are more accountable for performance. The student is told up front what he or she must do to complete the program. The majority of the responsibility for program completion is on the student.

   In a similar vein, since the tasks the student should master are known, the teacher can be held accountable for the student's learning of these tasks.

9. An open-entry/open-exit program is possible. It is possible in a CBVE program for students to enter a program at any time if there is room in the program, and to leave any time when the required or desired tasks have been achieved.

This is good for the following reasons:

- A. Some students may have the ability to only complete part of the curriculum and yet still be prepared for a job. Rather than keep them in school, they can exit to the job market through a cooperative education program, extended campus experience, or graduation.
- B. Some students, employees, or trainees may wish to only learn 10-15 tasks.
- C. Students from a given program can interface with students in other programs to learn tasks not available to them. For instance, horticulture students may go to marketing and accounting to learn specific business management tasks.

10. The teacher is a manager and facilitator of learning. The role of the teacher and the student is quite different in a CBVE environment. The teacher assists the student in learning by helping match resources with learning styles. The student, on the other hand, controls the resources without being "spoon fed" by the teacher. In a way, the teacher and student become "partners" in the teaching/learning process.

11. Students exiting a program are provided with a certificate of tasks achieved. Upon exiting a program, students are provided with a certificate which lists all the tasks they learned while enrolled in the program. This certificate is a handy resume for the students to show "what they can do", not what they may know.

12. Job-seeking and job-keeping skills are provided to the student along with related tasks necessary for job success. Research has shown that for the past 45 years, 85 percent of the employees fired was due to reasons other than skill performance. Some of these were: failure to show up for work, failure to work, safety violations, and failure to get along with the supervisor or other employees. Therefore, in a CBVE system, instruction includes tasks needed to

obtain and keep a job.

Related math, science, and other tasks should also be provided to the student.

13. List tasks by job title. It is recommended that tasks be listed by job title on the task list. Essential tasks to be completed for each job title should be identified.

Individualized Competency-Based Vocational Education: A Position Paper for Florida

Florida Division of Vocational Education

The state of Florida has long been recognized as a leader in competency-based education. The following resource endorsed by the Florida Division of Vocational Education is a position paper that explains the principles and procedures of individualized competency-based vocational education.

INDIVIDUALIZED COMPETENCY-BASED VOCATIONAL EDUCATION

A Position Paper
for Florida

A major effort to implement competency-based vocational education is underway in the state of Florida. The focus of this movement is on providing each learner with the specific knowledge and skills needed to obtain and hold a job in the field of his or her choice. The Florida Division of Vocational Education endorses the principles and procedures of individualized competency-based vocational education as described in this position paper.

What is individualized competency-based vocational education?

An individualized competency-based program is a systematic approach to vocational education with the following characteristics:

One The instructional content of the vocational program is based on *tasks performed and employability skills required on the job*. (In more traditional programs, curricula have been designed around broad topical areas rather than specific job tasks.)

Two The criteria used for evaluating student performance are determined by *job-performance standards*. (In many traditional programs the performance of each student is compared to the performance of the other students in the class. In individualized competency-based programs the prespecified standard by which competency is determined does not vary, with the result that grading becomes more objective.)

Three Each *task* to be performed, the *conditions* under which the student must perform, and the *standard* by which the performance will be evaluated are made known in explicit terms, in writing, to the student (and to any other interested persons) before instruction. The statement containing this information is often called a *performance objective*. (This, too, contrasts with traditional approaches, in which the knowledge and skills to be learned and the methods of evaluating student learning are commonly considered information solely for instructors.)

Four Content and pacing decisions are based on the instructional needs of the individual student—that is, on the discrepancies between necessary and current skill attainments. Ways of meeting those needs are determined by an *assessment of the student's aptitudes, learning styles, and career goals* (how far up a particular career ladder the student aspires to go). Therefore, at any one time, different students will be working on different objectives. (In traditional programs all students are expected to study the same curriculum, use the same materials, and spend the same amount of time on a unit or in the course. In individualized competency-based programs, both the amount of time spent in attaining competencies and the choice of learning activities vary among students, but the standard by which competence is determined does not vary.)

Five Each student is expected to acquire the necessary knowledge and skills to *demonstrate through performance* of each task that s(he) has reached the specified standard of performance. Since actual performance is the only reliable proof of competence, successful completion of the program is dependent on the student's demonstrated attainment of the knowledge and skills for which instruction has been provided. (In traditional programs student evaluation is often based on enabling knowledge rather than actual performance. A student may not be able to repair a carburetor without knowing its parts, for example, but that knowledge alone is not a sufficient guarantee of the ability to perform the repair.)

Why is individualized competency-based vocational education being implemented?

The rationale for individualized competency-based efforts is to be found in the advantages CBVE offers, both in the classroom and on the job. In the classroom, increased effectiveness and efficiency in learning may be anticipated. Instruction is more directly focused on job-performance requirements. Because each student's instructional program is based on his or her specific occupational goals, because each student knows in advance precisely what is expected, and because individual student differences are accommodated, the student is more highly motivated and efforts are more focused. Students take more responsibility for their own learning. And when students from competency-based programs join the work force, having met realistic and unvarying performance standards in the classroom, employers may confidently expect a more consistent quality of task performance on the job.

How is a vocational program determined to be individualized and competency-based?

An individualized competency-based approach allows for flexibility and variation in its application. Individualized competency-based programs will vary, since teacher and student characteristics, available resources, legal and administrative constraints, program requirements, and support services differ from situation to situation. Because of its inherent flexibility, an individualized competency-based program can—through an evolving process of implementation—be achieved wherever there is sufficient commitment. Although details may vary, all fully individualized competency-based programs in Florida will share the following characteristics:

One **Instruction in a competency-based program is based solely on the knowledge and skills (competencies) needed for a student to be successful in a specific job.** These competencies are identified by task analysis through on-the-job observation and interviews with incumbent workers. Periodic review ensures that competencies are valid and up to date. Thus, the tasks for which students are prepared are the tasks that workers currently employed in the job actually perform.

Two **Competencies are stated in such a way as to make objective assessment possible**. Competencies are tasks that workers perform on the job. Usually they are transformed or translated into performance objectives. Each objective specifies an observable and measurable task to be performed, the conditions under which the student will perform the task, and the standard for acceptable performance. In order to help focus the learning activities, the entire competency statement, including task, conditions, and standard, is made known to the student before instruction.

Three **Every learning activity is designed to prepare the student to attain a competency**—that is, to do a specified task under specified conditions and at a specified performance level.

Four **The conditions of performance and the assessment standard are derived from the nature of the competency**. In other words, a student demonstrates a skill competency by performing it rather than by writing about it. Both instruction and evaluation simulate actual job situations as nearly as possible. Performance in a realistic setting is the most valid method of demonstrating competence. Further, the performance standard is based on realistic job standards.

Five **The student's progress through an individualized competency-based program is determined by the demonstration of competencies rather than by the passage of an arbitrary number of hours or other period of time**. Both pacing and the choice of learning strategies are determined by the student, ideally as a result of teacher and/or counselor assistance.

Six **Completion of study occurs when the student attains all the selected competencies outlined in an individual plan of study**. When the student leaves the program for any reason, regardless of his or her status in relation to declared educational goals, s(he) is given a record of competencies attained in the program.

What is competency-based vocational education?

Competency-based vocational education (CBVE) can be defined as instruction for employment that is based on current job tasks, which are made known to each student before instruction and which, after appropriate instruction is provided, are to be performed by the student under prespecified conditions and according to prespecified standards. Since the goal of CBVE is to help every learner acquire the competencies needed on the job, and since individuals differ in the ways they learn best, instruction should be individualized—that is, it should be tailored to the individual student's abilities, learning styles, and career goals.

What is individualized instruction?

Although many of the procedures of competency-based education can be incorporated within the framework of a traditional, nonindividualized program, they are optimally suited to an individualized program. Therefore, although the two approaches—competency-based vocational education and individualized instruction—are not equivalent or necessarily interdependent, they are linked in this discussion, as in practice, because individualized instruction is the most appropriate method of delivering competency-based vocational education.

Individualized instruction is distinguished by its concentration on meeting the educational needs of the individual student. Recognizing that students enter a program with different abilities and that they learn at different rates and in different ways, the teacher of an individualized program seeks to respond with alternative instructional approaches. A student who demonstrates competence in a beginning skill may advance to an intermediate learning activity. One whose test results indicate a need may receive remedial instruction. The student who learns best by reading is provided with appropriate written materials in addition to the audiovisual and direct hands-on activities that may be better suited to another student. Individualized instruction does not preclude the use of whole-group instruction—such as the use of a film, lecture, or demonstration—when suggested by scheduling limitations or other efficiency or motivational considerations. Unless a class is exceptionally homogeneous, however, one would not generally expect the whole group to be involved in the same learning activity at the same time.

Competency-Based Education
(K-1 Prepare Yourself for CBE)

The National Center for Research in
Vocational Education

The National Center for Research in Vocational Education in Columbus, Ohio has produced over 125 performance-based teacher education (PBTE) learning packages. This outstanding series focuses upon specific professional competencies of vocational technical instructors. One component of the series (Category K-Implementing Competency-Based Education-CBE) is designed to enable instructors to implement and manage training programs embodying the principles and concepts of CBE. The following resource is from Module K-1 Prepare Yourself for CBE of the series.

For more information regarding Performance-Based Teacher Education Modules contact: AAVIM, American Association for Vocational Instruction Materials, 120 Engineering Center, University of Georgia, Athens , Georgia 30602, (404) 542-2586.

Activity 1

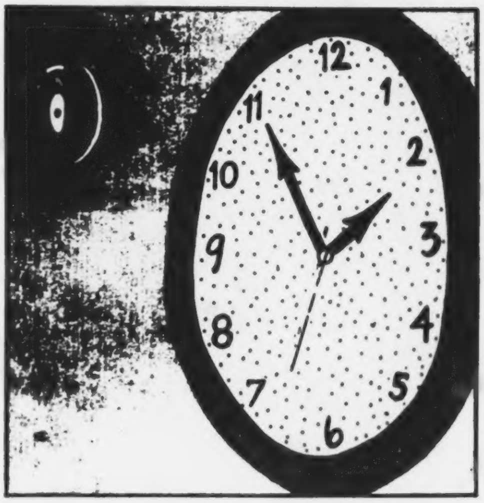
The competency-based approach to education is based on concepts somewhat different from those that form the basis for the conventional approach to education. For information on the nature of competency-based education, read the following information sheet.

COMPETENCY-BASED EDUCATION

Competency-based education (CBE) is considered by many to be one of the most significant educational innovations of the last fifty years. CBE has been endorsed at the local, state, and national levels, and it is also catching the attention of many international educators. CBE is a rapidly growing and sustained movement, which can lead to the improvement of instruction.

When educators visit CBE programs to observe them in action, however, what they see frequently does not tell the whole story. For example, in a fully functioning CBE program what may be visible is that students are working at their own pace on a highly individualized basis. Some students may have been in the program for two weeks, some for six weeks. The teacher may not seem to be "teaching" in the conventional sense of the word. CBE, in fact, may appear to be quite unstructured.

Nothing could be further from the truth. Indeed, it is its rigorous structure that is the strength of the competency-based approach. Let's look at this concept in more depth to uncover just what that structure is.



Essential Elements of CBE

Traditionally, educators at all levels have accepted the notion that learning is the variable and **time is the constant.** Whenever someone offers a course that involves a set number of hours of instruction, they are accepting this approach to education.

Having a set number of hours per course is admittedly an administrative convenience that is hard to give up. However, with that approach, teaching is often geared to covering as much information as possible in the time permitted and hoping that students will learn enough to allow them to be successful.

Many people feel that vocational and technical educators should be establishing programs in which **learning is the constant** and time is the variable. Vocational educators in many states are currently working hard to make this idea a reality in their programs through the implementation of CBE.

CBE differs, often significantly, from conventional approaches to training because of the educational philosophy upon which CBE is based. That philosophy, stated very simply, is as follows:

> Almost all learners can learn equally well if they receive the kind of instruction they need.

To make that philosophy work, CBE uses a very systematic approach to developing and delivering training.

The differences between CBE and conventional education can be illustrated by examining the steps involved in designing and offering a training program: determining what to teach, how to teach, what to test, how to test, and how to structure student progress through the program.

What to teach. The first—and probably most important—step in the instructional development process is determining what to teach: the content for a specific program. In conventional programs, program content is often derived based on topics listed in textbooks, skills included in curriculum outlines, and the instructor's own prior occupational experience. But textbooks, curriculum outlines, and the instructor's occupational experience often do not reflect the real world of work at the present time.

This leads to one of the basic strengths of the competency-based approach to training. The skills to be taught are identified by people who know best what tasks are performed in a given occupation: expert workers in the occupation.

CBE takes the view that it does not matter much what curriculum specialists think workers should be able to do, nor what instructors in the area think are probably the most important skills in the occupation. Instead, what really matters in determining the content for a training program are the tasks that current, skilled workers in the occupation actually perform.

Thus, the content of a CBE program is determined by a rigorous process of identifying the tasks performed by the worker on the job—the competencies (or skills) needed by the worker. When you know what tasks are performed by an employee in the world of work, you then know what skills to teach in your program.

Having arrived at this logical point in determining the content of a training program, CBE then goes one step further. The competencies to be achieved in a training program are made public. Thus, students know exactly what is expected of them in the training program. They know, in advance, the specific skills they must attain to succeed, both in the program and on the job.

All this can be summarized into the first essential element of CBE:

Competencies to be achieved are rigorously identified, verified, and made public in advance of instruction.

How to teach. Another essential element of CBE relates to managing the learning process. It is of utmost importance that learning be managed so that each learner has the opportunity to develop—and be evaluated on—the important occupational competencies that make up the program. This means that learning cannot be lockstep or by the numbers.

The competency-based approach acknowledges that people learn at different rates and in different ways. One person may learn more quickly, another more slowly, depending on the kind of task being learned.

Some people need a theoretical overview of the task before they can profitably attempt the task. They want to know how the process works before they try to use it. Other people need a hands-on, trial-and-success approach to a task from the very beginning. They want first to see the process demonstrated and to try it out. Then they may be ready to learn about the theory behind it.

One student might need the reinforcement of peers in group activities to learn effectively. Another student might be distracted by the group process; this student might learn best independently. The variation in the rate and style of learning from one learner to the next can be enormous.

CBE makes a point of accommodating this wide variation in potential rate and style of learning by providing for the individual development and evaluation of important occupational competencies. To the maximum extent possible, students are allowed to learn at their own best rate and in their own special way. This requires a shift away from the more conventional notion of whole-class, group-paced instruction.

It is not adequate, for example, to specify that **all** students will listen to a lecture, view a film, spend 45 minutes at practice stations in groups of three, have 15 minutes to ask any questions, and then sit down to take a test on the content to be learned. This will not meet the needs of all learners. The types of activities will be wrong for some, the sequence of activities will be wrong for others, and the pace of the activities may be wrong for most.

If time, money, and effort are invested in a training program, why not manage that training so that learning does, in fact, take place—in the most effective and efficient way possible. Thus, the second essential element of CBE:

The instructional program provides for the individual development and evaluation of each of the competencies specified.

What to test. A necessary part of any training program—whether conventional or competency-based—is testing to determine whether learning has occurred. Therefore, another step in designing a training program is to determine exactly what is to be tested.

In this matter, CBE again differs from more conventional approaches. CBE emphasizes proficiency and performance above all else. Consequently, the final measure of competence is whether the student can actually **perform** each competency according to given criteria.

This does not, by any means, ignore the importance of knowledge and attitudes. Attitudes are critical, but they can be tested through observation of performance. Knowledge is recognized as an essential prerequisite upon which performance is founded—and knowledge should be tested—but it is not an end in itself.

What ultimately matters—to both trainees and employers—is the trainees' ability to perform tasks, not just knowledge of how to do so. After all, if you have a leaky faucet, what kind of plumber do you want to fix it? One who can wax eloquent on the principles of hydraulics? Or one who can stop the leak?

This leads to the third essential element of CBE:

Assessment of competency takes the student's knowledge and attitudes into account but requires actual performance of the competency as the primary source of evidence.

How to test. Another step in the process of designing a training program is to determine how to evaluate students' learning. In many conventional programs, a norm-referenced grading system is used. In such a system, the achievement of one student is compared to that of the other students, with a minimum grade requirement constituting successful achievement.

Furthermore, with such an approach, there is often an element of the unknown. To test students' "actual knowledge," the exact questions to be asked are not given out in advance. And if no one gets 100 percent of the answers correct, the test may be graded "on the curve." Thus, in conventional programs learners may not know, until they get the tests back, how "well" they did—in comparison to the other students.

CBE, on the other hand, focuses on each student's ability to perform specified occupational tasks according to established occupational standards. And the view is taken that it does not harm the learning process if everyone knows beforehand precisely how students' performance on occupational tasks will be evaluated. On the contrary, if learners know in advance exactly how to judge whether their performance is correct, their learning will likely be both more efficient and more effective.

This approach to evaluating learning does depend, of course, on having valid, specific, high-quality criteria by which to judge performance. Fortunately, an excellent source is available for determining the criteria needed in developing the performance checklists that will be used to evaluate performance: the occupation itself.

Just as expert workers in the occupation are used to identify the important occupational competencies, current occupational practices indicate what criteria are actually used in the occupation to judge successful performance.

Thus, the fourth essential element:

Criteria to be used in assessing achievement and the conditions under which achievement will be assessed are explicitly stated and made public in advance.

How to structure progress. Student progress in a CBE program depends on only one thing: attainment of the important occupational competencies. Students do not study a topic for two weeks, take a written test on it, and then go on to the next topic regardless of how they did on the test.

In CBE, students move ahead to the next competency when they can successfully perform the competency currently being worked on. In theory, it doesn't matter whether it takes a trainee one day, one week, or one year to successfully perform a given competency. (In practice, reasonable time constraints usually operate.)

What matters is that the trainee **learns** and performs one competency successfully before moving on. Students cannot simply accept a poor or failing grade on a particular unit and then attempt to progress through further work, lacking prerequisite knowledge or skill. Neither can they hope that a poor rating on one competency will be offset by an especially high rating on another. Each competency counts.

A parallel concept is that students are considered to have completed the program only when they have mastered all the specified skills, not when the calendar or clock says they have. It isn't important that a student has been enrolled for an academic year or has put in 1,240 hours of attendance. What is important is that he or she has acquired the skills needed to get and hold a job in the occupation.

The fifth and last essential element of CBE, then, is as follows:

Students progress through the instructional program, at their own best rate, by demonstrating the attainment of specified competencies.

You have seen thus far how the basic decisions about content, instruction, testing, and student progress are made in competency-based programs. Designers and implementers of every well-developed CBE program use these principles in formulating instructional and management procedures.

Facilitating Characteristics of CBE

In addition to the five essential elements of CBE programs, there are a number of facilitating, or supporting, characteristics that should be part of any CBE program. These can be grouped into instructional characteristics and administrative characteristics. Although there are variations among programs, most mature, fully functioning CBE programs exhibit most, if not all, of the characteristics listed in the following two facilitating categories.

It is these facilitating characteristics that help to bring the potential of CBE into full reality. They allow students to learn efficiently and instructors to teach effectively. They make vocational-technical education more rational and relevant than ever.

Facilitating instructional characteristics. The instruction is designed to include the following elements:

- The instructional materials used (e.g., learning guides or modules) are keyed to the competencies to be achieved.
- Environments that duplicate or simulate the work place are available to students during competency development.
- Basic knowledge or background theory is learned as it is needed to support competency development.
- Students are informed about the traits and attitudes important to workers in the occupation and are periodically evaluated regarding their attainment.
- Each student is given continual and detailed feedback on competency development.
- A variety of learning styles and teaching strategies is provided for.
- Students with appropriate prerequisite skills and knowledge may bypass instruction on competencies already attained.

Facilitating administrative characteristics. The program is organized and supported administratively to include the following elements:

- Program completion is based on satisfactory achievement of all specified competencies.
- Students can enter and exit from the program at different times.

- Individual student records are maintained and reflect student progress at any given point in time.
- Materials, space, and equipment are available when needed by students and instructors.
- The record-keeping system permits student transfer into and out of the program without requiring duplication of instruction on competencies already achieved.
- The requirement of a designated number of hours of instruction is removed from the criteria for program completion.
- Records of competency attainment are provided to students and prospective employers.
- Student grades, if used, reflect the level of competency achievement attained.
- Credit, if awarded, is given for competencies achieved as a result of instruction and for demonstration of previously acquired competencies.
- Student fees are individually assessed and are based on the time actually spent in the program and the instructional resources used.

The extent of your involvement in the implementation of these administrative characteristics will, of course, depend on your particular situation. It may be that you are trying to implement CBE on your own, in your own program; in that case, your role may be to convince the administrative staff that some of these characteristics are required to support your efforts.

On the other hand, you may be part of a CBE implementation team in a schoolwide effort; in that case, it may be your responsibility to actually provide for these administrative characteristics. Or the school may be moving systematically to ensure that the CBE program includes all these characteristics, and you may not need to be involved at all.

Implementing the Elements and Characteristics

If you read about CBE in the literature and talk to various educators who have a great deal of experience in implementing CBE, you will find some variations in what people present as the essential elements and facilitating characteristics of CBE. However, these variations tend to reflect differences in emphasis rather than differences of opinion concerning what a fully functioning program looks like.

In fact, the goal remains the development of CBE programs that possess all the essential elements and most of the facilitating characteristics discussed. But exposure of the concepts underlying CBE to the realities of conventional vocational-technical programming has revealed some practical concerns. Trying to move, in one step, from a highly conventional program to one that includes all the essential elements and facilitating characteristics of CBE often has disastrous results.

Faced with the idea that they will have to immediately implement a CBE program exhibiting all the essential elements and facilitating characteristics, some schools have abandoned the idea of implementing CBE before they have even begun. For example, some secondary schools could not conceive of taking such an extreme step as allowing for open-entry/open-exit. Other schools knew they did not at present have the resources (staff, time, money) to develop individualized learning guides. And, as a result, these schools sometimes assumed that CBE was not for them.

Consequently, some experts suggest that, in many cases, CBE is more likely to be implemented successfully if it is implemented incrementally. In other words, it is far better to take one step at a time—and to get each element securely in place before proceeding to the next element.

To that end, you could focus first on establishing the groundwork for CBE: rigorous identification of (1) the actual tasks performed by incumbent workers on the job and (2) the criteria by which performance of those tasks is assessed.

The identified tasks, or competencies, can be used as a basis for developing instruction. And the criteria can be used in developing criterion-referenced performance checklists for measuring student achievement of the requisite competencies.

Furthermore, once both competencies and criteria have been identified and established, these can be made public to students in advance of instruction.

At that point you would have addressed three of the five essential elements:

- Competencies to be achieved are carefully identified, verified, and made public in advance of instruction.
- Assessment of competency takes the student's knowledge and attitudes into account but requires actual performance of the competency as the primary source of evidence.
- Criteria to be used in assessing achievement and the conditions under which achievement will be assessed are explicitly stated and made public in advance.

Initially, however, the instructional mode used to teach those competencies and to assess student performance may be fairly conventional—teacher-directed, group-based, and group-paced.

It is highly unlikely, though, that instruction will remain conventional for very long. Once those three essential elements are in place, the need to implement the remaining essential elements and the facilitating characteristics usually becomes quite obvious.

For example, it should become readily apparent that, as students work to achieve competencies, they do not all progress at the same rate. What then do you do with those who are moving more slowly or more rapidly than the group pace set? How do you find time, within group instruction, to individually evaluate student performance on individual competencies? Clearly the instructional delivery system will have to be modified accordingly. In fact, it will need to be modified to incorporate the remaining essential elements:

- The instructional program provides for the individual development and evaluation of each of the competencies specified.
- Students progress through the instructional program, at their own best rate, by demonstrating the attainment of specified competencies.

And in order for the instructional program to provide for the individual development and evaluation of competencies and student self-pacing, you would inevitably discover that you need to implement some or all of the facilitating instructional characteristics previously described.

The natural evolution of the implementation process does not end there. In fact, once the essential elements and facilitating instructional characteristics are established, it will become equally clear that the system won't work well unless the existing administrative characteristics are modified—or new procedures are developed—to accommodate the elements of the CBE system.

This is not to suggest that CBE should be implemented blindly, without planning in advance for the changes that will ultimately be required to support its implementation. Rather it is an acknowledgement that many conventional programs find it difficult if not impossible to fully implement CBE all at once.

Instead, therefore, it is recommended that such programs move slowly and methodically into implementation such that the foundation is first laid . . . and then the instructional design is systematically modified to accommodate that existing and solidly laid foundation . . . and finally the administrative procedures are revised as necessary to accommodate the instructional design. In that way the changes can evolve and the CBE program can grow into maturity incrementally and naturally.

Advantages of CBE

Much work is yet to be done to document the effects of competency-based instruction. Enough is already known, however, to have identified a number of genuine advantages of this approach. These may be characterized as educational advantages (i.e., effects on students) and management advantages (i.e., effects on schools).

Among the most important **educational reasons** for implementing a CBE approach are the following:

- More learners achieve competence than is possible in group-centered instruction.
- Learners may achieve competence in a shorter period of time.
- The learner builds self-confidence and self-esteem by succeeding in learning.
- Students learn to help each other rather than compete for grades.
- The content of instruction is well organized and consistent.
- The final result is an entry-level worker who is more uniformly prepared in basic occupational skills and abilities.
- Students can learn according to their preferred learning styles.
- Students are not required to repeat learning of skills previously acquired.

Secondary and postsecondary occupational programs designed to capitalize on the educational advantages of CBE find that there are very significant administrative and management benefits to this approach as well. In fact, it can be argued that the **management reasons** for CBE are in themselves justification enough. Among the most important of these reasons are the following:

- Students can obtain ready access to instructional programs.
- Students with a wide range of skills can be accommodated.
- Programs are readily revised and kept current.
- The instructional staff can be utilized more efficiently.
- Facilities can be utilized more fully and efficiently.
- The placement of graduates in jobs is facilitated.
- Students with special/exceptional needs can complete segments of an instructional program—segments selected with their specific needs and abilities in mind.
- Vocational-technical programs develop and maintain stronger linkages with business, industry, and labor.

CBE Terminology

It should be noted that, in this newly developing movement, the terminology used in discussing CBE varies widely. Terms and acronyms for such programs abound. In addition, the terms used to describe the different elements of CBE programs are numerous, as illustrated in sample 1.

These differences in terms are not, in themselves, important. What is important is that **all** CBE programs, regardless of the specific terms attached to them, should be developed based on the essential elements and facilitating characteristics described previously in order to be considered truly competency- or performance-based.

SAMPLE 1

CBE TERMS

Competence: Achievement—to a specified degree of proficiency—of the knowledge, skills, and attitudes required by a worker in order to perform a given occupational task. Also frequently called *skill.*

Competency-Based Education (CBE): An instructional program for preparing students in which the emphasis is upon students' developing and demonstrating specified occupational competencies as measured by performance tests. Other terms used are *performance-based education (PBE), competency- based* or *performance-based instruction (CBI, PBI),* or *competency-based vocational education (CBVE).*

Competency Profile: A graphic portrayal of all the duties and associated tasks performed by workers in a given occupation.

Criterion-Referenced Evaluation: The evaluation of student performance based on occupational standards established in advance of instruction, rather than on comparisons between or among students.

Curriculum: A description or series of statements about what is to be learned by a student in a particular instructional program (i.e., a product that states the intended learning outcomes).

DACUM: An acronym for **D**eveloping **A** **Cu**rricu**lum**, an approach to occupational analysis that involves bringing occupational experts together under the leadership of a trained facilitator.

Individualized Instruction: An approach for managing the instructional process within which the focus is on helping individual learners (as opposed to groups of learners) acquire the knowledge, skills, and attitudes needed, in a manner designed to accommodate their unique differences.

Instruction: Whereas curriculum identifies the instructional content (what is to be learned), instruction is the process (the **how** or the means) by which the intended learning will be achieved.

Learning Package: A general term used to describe the many types of student learning materials used in CBE programs. Two of the most commonly used types are learning guides and modules.

- **Learning Guide:** A type of learning package that usually contains a terminal objective, enabling objectives, directions for learning activities, a listing of the external supportive resources needed, and evaluation activities. While learning guides are developed in a wide variety of formats, most depend on external resources to provide the content needed.
- **Module:** A type of learning package that usually includes a terminal objective, enabling objectives, essential cognitive information, and evaluation activities. While modules are also developed in a wide variety of formats, most are self-contained, transportable, and designed for individual or group use.

Occupational Analysis: A process used to identify the duties and tasks that workers perform in any given occupation. A number of alternative and acceptable approaches to occupational analysis are available. Also frequently called *job analysis.*

- **Duty:** An arbitrary clustering of related tasks into a broad functional area or general area of responsibility. Duties are also called *duty areas* or *general areas of competence (GAC).*
- **Task:** A work activity that is discrete, observable, and performed within a limited period of time, and that leads to a product, service, or decision. Tasks are also frequently referred to as the *skills* or *competencies* that students or trainees must possess in order to be successful workers.

A Competency-Based System of Learning

Ridge Vocational-Technical Center
Winter Haven, Florida

Ridge Vocational Technical Center in Winter Haven, Florida is recognized as a leading CBE vocational technical school in the United States. This institution has demonstrated that CBE is an effective instructional delivery system. The following resource is a copy of a page from a booklet that explains to students the Ridge philosophy and system of learning.

LEARNING AT RIDGE VOCATIONAL-TECHNICAL CENTER

AN INDISPENSABLE
GUIDE GUARANTEED
TO EXPLAIN BEYOND A
DOUBT WHAT'S IN A
LEARNING GUIDE AND
WHAT'S AT THE
GUIDANCE OFFICE.
HOW TO FIGURE YOUR
TIME CARD AND HOW
TO FIGURE YOUR
GRADES. WHAT'S IN A
STUDENT PERFORMANCE
AGREEMENT AND
WHAT'S IN A SHOP
SAFETY AGREEMENT.
WHERE TO GET AN
ADMITTANCE FORM
AND WHERE TO GET A
WARM LUNCH. WHAT'S
ON THE AGENDA OF
COURSES AND WHAT'S
ON THE AGENDA FOR
YOU. HOW TO
BECOME EMPLOYABLE
AND HOW TO GET
YES. EMPLOYED.

A COMPETENCY-BASED SYSTEM OF LEARNING

At Ridge we are using a system of learning called competency-based vocational education.

What does *competency-based vocational education mean?*

A competency-based vocational program is centered around the individual strengths, needs, and learning styles of the student. It is a very personalized system that has the following characteristics:

- ongoing programs
- open entry and open exit
- variable learning time
- credit granted for work completed
- evaluation (grades) based on performance
- fixed content

Classes are offered according to student demand, and may go on continuously all year. The classroom vacancy that occurs when a student exits from a program may be filled immediately by another student waiting to begin. Students do not have to start classes only in September or January.

The time it takes to complete a program varies. If you can attain a skill by completing a pretest, you may proceed to new material in the program. Thus you can learn according to your preferred learning style and move forward at your individual pace. The performance test or evaluation is always based on predetermined and stated standards of performance.

BENEFITS TO YOU

A competency-based vocational training program has several very important benefits for you:

- You know from the beginning exactly what skills and knowledge you must attain to complete the program successfully. (You will be given a list of these.)
- You know in advance how well you must perform on all knowledge tests and all performance tests to attain the required knowledge and skills.
- You can see exactly how you will be evaluated.
- Your progress or performance is not compared to that of other students. It is compared to a fixed *standard.*
- If you have already attained certain skills required in your program, you may simply demonstrate that you have attained them and begin focusing your attention on skills you have not yet attained.
- You are able (without penalty) to go back over learning materials several times if needed in order to attain the skill or knowledge.
- You can spend as much time (within reason) on a skill as you need in order to attain it.
- If you are able to attain the skills easily, you may speed your rate of progress through the program.
- You complete the program when you have attained all the required skills; your exit is not restricted to any date. This makes your timing for landing a particular job more within your control.
- You may participate in the Industrial Cooperative Education (ICE) program, which allows you to earn credit for outside employment in an area related to your training program at Ridge.

WHAT'S REQUIRED OF YOU?

For this system to work, you will be expected to:

- Assume the responsibility for learning. Your instructor will give you assistance, but the actual responsibility for learning rests with you, the student.
- Utilize the materials provided for you. Student learning guides and other aids have been carefully developed to help you learn.
- Devote your energy to attaining the skills and knowledge required for your particular program.

THE INSTRUCTOR'S ROLE

Instructors at Ridge are referred to as *learning managers* in our competency-based vocational education (CBVE) system. They work with students individually and guide them through the learning process with the aid of many different resources. If you are having difficulty, you should go to your instructor with your problem. The instructor's goal is to find the most effective way to help you attain the tasks in the vocational program you selected.

CBE: An Effective and Realistic Approach to Vocational and Technical Education

(by Robert Norton)

"CBE: An Effective and Realistic Approach to Vocational and Technical Education" was written by Robert E. Norton and provides a straightforward and concise description of competency-based education. Dr. Norton is a Senior Research Specialist at the National Center for Research in Vocational Education in Columbus, Ohio.

CBE: AN EFFECTIVE AND REALISTIC APPROACH TO VOCATIONAL AND TECHNICAL EDUCATION

by Robert E. Norton

Essential Elements and Desirable Characteristics

Traditionally, in all of education, we have accepted the option of making learning the variable and time the constant. Whenever we say that a course involves so many hours of instruction, we are openly admitting our acceptance of this historical approach to education. A set number of hours per course is admittedly an administrative and planning convenience that is hard to give up. However, under these circumstances, our teaching is often geared to covering as much information as possible in the time permitted, in hopes that enough will be learned to allow our students to be successful.

Many persons feel it is about time that those of us involved in vocational and technical education should be opting to implement programs in which learning is the constant and time the variable. Vocational educators in many states, including New York, Kentucky, Florida, North Carolina, and Pennsylvania, are currently working hard to make this option a reality in their vocational and technical education programs through the implementation of competency-based education (CBE).

Before proceeding, it should be noted that terms and acronyms for these programs abound: CBE, PBE, CBSD, CBAE. What is important is that all such programs, regardless of the specific names attached to them, should possess the essential and desirable characteristics described below in order to be considered truly competency- or performance-based. See figures 5 and 6 to review with some of the many competency/performance-based terms and acronyms being used, their meaning, and the common and unique factors associated with each type of program.

To understand fully the meaning of CBE, one must be aware of the essential elements and desirable characteristics of such programs.[1] There are five essential elements:

1. Competencies to be achieved are carefully identified, verified, and made public in advance--This simply means that the important entry-level competencies for any occupational program area must be identified in some appropriate manner, verified as relevant by experts who should know that field , and then made known to students and everyone else interested in what the program is designed to teach.

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[1] The essential elements and desirable characteristics presented here are adapted from Achieving the Potential of Performance-Based Teacher Education: Recommendations, PBTE Monograph Series: No. 16 (Washington, DC: American Association of Colleges for Teacher Education, 1974).

2. Criteria to be used in assessing achievement and the conditions under which achievement will be assessed are explicitly stated and made public in advance--This means we are going to eliminate guessing games about what parts of the course are important and tell students exactly how their performance will be evaluated. The implementation of this essential element also means that we are giving up the traditional norm-referenced approach to the evaluation of student achievement in which the focus is on comparing a student's progress with that of other students. In its place, we are adopting the criterion-referenced approach in which each individual student's progress is compared with previously established criteria that are made known to all who are concerned.

3. The instructional program provides for the individual development and evaluation of each of the competencies specified--What we are saying here is simply that each student shall be given the opportunity to develop each of the competencies important to his/her training program, and that each student will be given the opportunity to demonstrate attainment of each competency. This essential element has strong implications regarding the need to individualize CBE programs to the maximum extent possible and for the type of instructional materials needed to make individualization possible.

4. Assessment of competency takes the students' knowledge and attitudes into account but requires actual performance of the competency as the primary source of evidence--CBE goes beyond the traditional educational expectations that students should know the "how " and "why" of things and places a strong emphasis on the "ability to do" as well. Of course, in order to perform a task correctly, the student will need to acquire the necessary prerequisite knowledge and attitudes involved, however, does not by itself ensure the student's actual ability to perform important competencies. It is with regard to this essential element of CBE that many programs fall short, relying instead only upon paper-pencil tests of cognitive understanding as proof of competency. While such measures can appropriately be used to assess prerequisite knowledge, they must be supplemented by performance-oriented, process-and-product checklists or other measurement devices that permit assessment of the student's actual ability to perform the expected competencies.

5. Students progress through the instructional program at their own rate by demonstrating the attainment of specified competencies--Said in another way, we want to make time the variable and learning the constant. Again, it is clear that some individualization of instruction is called for. While student progress is dependent upon the demonstration of competencies, this element does not mean that reasonable time limits cannot be imposed upon the students. Some persons may want to interpret this element to mean that only the student is accountable for his/her progress. Not so--a CBE program places accountability for learning squarely upon the shoulders of both the learner and the instructor.

The additional desirable characteristics of CBE programs are as follows:

1. Instruction is individualized to the maximum extent possible, rather than group-paced.

2. Learning experiences are guided by frequent feedback.

3. Emphasis is on helping the student achieve program exit requirements.

4. Instruction is individually paced rather than time-based.

5. Instruction is, to a considerable extent, field-centered--based on realistic work problems and situations.

6. Instruction is often modularized and uses materials with both required and optional learning activities to help achieve flexibility and provide for different learning styles.

7. The program as a whole is carefully planned and systematic (e.g., concerned staff are involved in planning, and evaluation data is used for program improvement).

To help the reader visualize some of the major differences between a CBE program and a conventional program of vocational education, twelve factors related to each of the programs are presented below. Admittedly, few of today's programs would meet exactly the criteria for either type of program. While most actual programs are probably located somewhere between the two extremes, the comparison helps to summarize some of the basic differences inherent in the two approaches.

	Conventional Vocational Programs	Competency-Based Vocational Programs
1.	Content-Based	Competency-Based
2.	Time-Based	Performance-Based
3.	Group Paced	Individually Paced
4.	Group Needs	Individual Needs
5.	Delayed Feedback	Immediate Feedback
6.	Textbook/Workbook Materials	Modules and Media Materials
7.	Limited Field Experience	Learning in the Field
8.	Lectures, Demonstrations	Assistance of Resource Person
9.	General Objectives	Specific Objectives
10.	Subjective Criteria	Objective Criteria
11.	Norm-Referenced	Criterion-Referenced
12.	Final Grades	Student Competence

Component B

Identifying and Validating Student Competencies

Purpose

The purpose of **Component B** of the Resource Guide is to assist instructors in developing a list of competencies that have been validated by business and industry as necessary for successful entry level employment in a specific occupation. A good competency-based training program should base all instruction on industry validated competencies. The writing of performance objectives is also discussed in this component.

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What are Competency (Task) Statements? B-1

Component A of the Resource Guide outlined the seven major steps that typically take place as a competency-based program is developed. Once again these seven steps are:

1. Determine the overall design of the CBE system of learning.
2. Define program scope, job titles included and student characteristics.
3. Identify and validate student competencies.
4. Develop student learning materials.
5. Organize the physical facility for CBE.
6. Develop CBE management system.
7. Develop and follow a CBE implementation plan.

The first two steps, 1. Determine the overall design of the CBE system of learning. and 2. Define program scope, job titles included and student characteristics. were briefly discussed on pages 28-29. The first two steps really cover the overall design and conceptualization of the CBE process as it is to operate within your program or school and defines the intended goals, mission or focus and the typical clientele served.

The first two development steps, although important, are not terribly difficult or time consuming to develop. If the competency-based education implementation effort you are involved with is a school-wide or district-wide effort, step #1 in all likelihood will already be developed for the entire school or district.

The resource section of this component contains a list of questions that need to be answered before determining the overall design of a CBE system of learning. This list of questions was obtained from a Self-Instructional Competency-Based Professional Teacher Training Manual (Task 015, TPO 15 pg 21-29) developed by the Competency-Based Individualized Vocational Educational Consortium of Addison, Illinois. This information is located on page 120.

Much of the information needed to accomplish step #2 (**Define program scope, job titles included and student characteristics**), is already available in the form of existing program descriptions and philosophy statements, school or district information explaining the intent of the training program and local employment survey data. In fact, the basic standards established by the Coordinating Board require that courses or programs wholly or partially financed by state funds are subject to prior approval and continuing review. If a community college or technical institute is within the guidelines established by the Coordinating Board (Postsecondary Technical and Vocational Adult Course Approval, Chapter 9 Subchapter J.) then step #2 should already be in place. Normally step #1 and #2 are administrative functions and not the responsibility of instructors at the classroom level.

Step #3, Identify and validate student competencies is probably the first major activity (assuming steps 1 and 2 are completed) that instructors at the program level will be actively involved with. Completion of step #3 will result in a list of competency or task statements. All further development in competency-based education is based on this task list.

Identifying and validating the actual competencies upon which the program will be based is perhaps the single most important step in CBE program development! Although this activity represents only about 10% of the total time and effort required to develop an operational CBE program, it effects the other 90% dramatically.

The critical role of competency identification can be compared to the function of drawing blueprints for constructing a building. Drawing blueprints for a building represents only a small fraction of the total time and cost involved in the overall structure but mistakes, omissions and poor planning in the design of the blueprints can cause serious delays, problems and cost overruns in the actual construction.

The competency identification step is critical to developing a good, practical and workable CBE program. There have been several instances of instructors and adminstrators attempting to implement competency-based education programs based on inappropriate or unsound competencies. This fact has lead to the ultimate failure of many CBE development efforts. It is absolutely mandatory that a good listing of competency statements be developed. A poor job of identifying and validating competencies will almost guarantee shoddy curriculum materials and a less than effective CBE program.

Many vocational technical programs have had problems by emphasizing or including too many of the wrong kinds of competency statements. Based on the experience of many schools throughout the United States and Canada involved in implementing competency-based education, the following approach concerning competency statements is recommended.

Most (90%-100%) of the competency statements listed for a competency-based program should describe the actual skills, procedures or tasks performed by entry level workers in the occupation.

If most or all of the competency statements generated for a training program are "job skills" or "job tasks" such as:

- * Bend electrical conduit
- * Discharge patient from hospital
- * Take spinal x-ray
- * Install rafters
- * Arrest traffic violator
- * Troubleshoot pulse encoders

the following benefits will be realized:

1. If the competency statements upon which the CBE program is based are the same competencies (tasks) performed by actual workers on the job, graduates of the training program will learn exactly what they need to become employable.

2. The educational experience will be more interesting and motivational for students when most of the tasks they are learning are "hands on" activities. In this type of learning environment students seem to have better attendance and attitudes.

3. Theory, concepts, factual knowledge, terminology and affective attitudes can be taught "along the way" throughout the training program when and where they are needed to support the competent performance of job tasks. For example, students can be taught the theory of how transducers work when they are learning the competency "Analyze and troubleshoot transducers". Students will find it more meaningful and probably easier to learn the math and physics involved in designing roof trusses while they are actually learning the competency "Design and layout roof trusses".

4. Identifying competencies allows testing to be more performance oriented. Testing will focus more on evaluating what the student can do rather than what they say they can do.

5. The resulting list of competencies will provide employers, advisory committee members and other interested individuals an objective listing of the actual skills a student is able to perform. Course outlines and descriptions are often very subjective and open to individual interpretation of what is being taught.

On the following page is an example of a page from a task listing from the Mechanical Electrical Technology program at Texas State Technical Institute Amarillo.

TSTI AMARILLO

TASK LISTING

PROGRAM: MECHANICAL ELECTRICAL TECHNOLOGY

TASK NO.	STD. HRS.	
DUTY A	290	MAINTAINING ELECTRICAL SYSTEMS
01	8	Identify electrical distribution systems
02	4	Troubleshoot over-current protection devices
03	20	Construct an industrial electrical distribution system
04	4	Compute wire, conduit, and electrical box sizes
05	4	Install simple electrical loads and switches
06	4	Troubleshoot single-phase motors
07	2	Analyze synchro motor
08	2	Analyze servo motors
09	4	Troubleshoot three-phase motors
10	3	Troubleshoot electro-mechanical relay
11	3	Troubleshoot solid-state relays
12	27	Troubleshoot electro-mechanical magnetic motor starter
13	4	Troubleshoot solid-state motor starter
14	4	Troubleshoot two position automatic controls
15	4	Troubleshoot three position controls
16	3	Test motor capacitor
17	3	Analyze logic functions
18	3	Troubleshoot manual AC motor starters
19	2	Troubleshoot magnetic solenoids
20	14	Troubleshoot time delay circuits
21	2	Troubleshoot circuits using various industrial pushbutton and selector switches
22	5	Troubleshoot three-phase reversing starters
23	3	Operate a motor circuit using a joy stick
24	2	Troubleshoot circuits containing mechanical limit switches
25	2	Troubleshoot circuits containing pressure switches
26	2	Troubleshoot circuits containing flow control devices
27	2	Troubleshoot drum switch
28	6	Troubleshoot reversing circuits
29	8	Troubleshoot photoelectric controls
30	2	Troubleshoot a circuit containing solid state electronic switching
31	4	Analyze AC reduced voltage starters
32	2	Analyze accelerating and decelerating methods for AC motors
33	4	Operate and troubleshoot photoelectric circuit with latching electronics
34	4	Operate and troubleshoot photoelectric circuit using time delay
35	4	Construct and operate general purpose photoelectric circuit with solid state output

TOTAL TASKS	TOTAL STD HRS	REVISED:							

After reviewing the sample page from the task listing the following factors are evident:

* Every task (except A01) is a "hands-on" activity that is actually performed on the job.

* The task listing describes in occupational terminology exactly what the program teaches, what students learn and what employers can expect graduates to be able to do.

At this point a definition of a task will be included. Remember for the purposes of this resource guide the words "task" and "competency" are interchangable.

Definition: Task

A job task is a complete, useful unit of work actually performed by workers on the job. A job task is observable, has a definite beginning and ending point and describes exactly the product or service that is being produced or performed.

Sources of Task Statements

If you follow the approach of having most or all of your competency statements be "hands-on" tasks that are actually performed on the job; then the source of these competencies should of course be from the occupation you are training for. However, that is not as easy as it sounds because few instructors have the time, funds or skills required to formally analyze an occupation breaking it down into tasks or procedures performed by entry level workers. It would be rather time consuming to observe actual workers on the job and determine exactly what it is they do on a day to day basis. This process would be further complicated because you would have to visit many different locations to get a realistic appraisal.

There are several "shortcuts" that can be used to obtain the information needed to develop a competency-based training program. Your ultimate goal, remember, is to base your competency statements on the actual job skills performed in the workplace without having to do a long, drawn out analysis of the job (or cluster of jobs). These shortcuts include:

1. Base your competency statements on formal analysis of the occupation that have recently been carried out by others.

2. Have representatives from the occupation come to you to describe what is done on the job on a daily basis.

3. Develop a tentative list of job competencies from appropriate up-to-date sources and have workers from the occupation "validate" or "verify" these competencies by responding to a survey.

4. Some combination of the above techniques.

Many instructors may wonder why in all of the four approaches listed we are asking others to tell us what tasks are performed by workers on the job. If an instructor has worked for years in the occupational field why can't he or she just write down the tasks they remember doing on the job? The problems often resulting from instructor generated competency listings include:

* Too often the instructor's work experience has been a number of years ago. Technology, procedures, equipment and materials often change dramatically over a period of time.

* The instructor's experience, although extremely valuable to the training program, sometimes represents a limited number of employers who have done things "their way" using perhaps a single make or brand of equipment or a particular technique that is not common to the industry as a whole.

* There is always the possibility of instructor bias in developing a competency listing. Some instructors have a tendency to emphasize certain skills over others depending on the instructor's background. For example, if an automobile mechanics instructor spent many years repairing automatic transmissions he or she might concentrate on automatic transmission repair at the expense of another area such as electrical systems.

* Some instructors tend to include competencies that are far beyond entry level skills often ignoring some of the basic skills.

On page 77 four techniques for obtaining competency statements were listed. Method #3 Develop a tentative list of job competencies from appropriate up-to-date sources and have workers from the occupation "validate" or "verify" these competencies by responding to a survey, has proven to yield satisfactory results if done correctly. This technique of competency identification and validation will be discussed in this component of the Resource Guide.

Method #2, Have representatives from the occupation come to you to describe what is done on the job on a daily basis, (often called the DACUM process) is very effective but requires a skilled facilitator to carry out the process and it is often difficult to find 8 to 12 "exemplary" workers who can spend the two to three days necessary to complete the process. Information concerning method #2 (DACUM process) is located in the resource section (page 118) of this component.

Information relevent to method #1; Base your competency statements on formal analysis of the occupation that have recently been carried out by others is also included in the resource section of this component of the Resource Guide.

Developing a Task Listing

The following information will provide an instructor with a step-by-step procedure for developing a competency (task) listing.

Step 1

Step #1: Carefully Review the Results of the Second Step in the Overall CBE Development Process (Define program scope, job titles included and student characteristics) and Determine Specifically What Job Titles or Job Clusters the Final Competency (Task) Listing Should Cover.

Step #1 is rather simple but is often ignored by many training programs. For example, if you are beginning to identify and validate program competencies for a training field such as office occupations you need to determine whether the list of competencies you are about to develop should cover classifications such as medical secretary, legal secretary, general secretary, bookkeeper, receptionist or one of many other specific jobs related to office occupations. Some training programs may represent only one or two specific narrowly defined job titles such as commercial vehicle driver or dental assisting while others such as welding might cover many job titles (i.e. pipe welder, tack welder, structural welder, etc.).

Technical education programs, especially at the associate degree level may find it appropriate to focus on looking at various job titles that are representative of a wide array of jobs graduates typically get. It is almost impossible to assign two or three specific job titles for which electronics technology graduates would be hired. Electronics technology graduates may be hired as bench technicians, equipment installers, service technicians or a host of other related positions. Competencies identified for such programs should be representative of the competencies performed by technicians in the field.

Instructors must be careful in identifying the occupation they are developing competency (task) lists for. They must be careful not to define the occupation too narrowly or too broadly. Too narrowly defining an occupation may result in training programs whose graduates may be limited in the job opportunities they qualify for. Too broad a definition may result in a training program whose graduates receive only general training in a wide variety of tasks.

Try to be as specific as possible when defining an occupation. Remember specific occupations are the actual occupations people are being hired for. There are several sources to assist you in identifying specific occupations. The following sources are often helpful in generating a list of specific occupational titles:

- Dictionary of Occupational Titles
- Occupational Outlook Handbook
- Help Wanted Classified Ads.
- Program Advisory Committee
- Interviewing Employers Within the Occupational Areas
- Reviewing Materials Developed by Other Schools
- Your Own Knowledge of the Field

Once you have identified what specific occupational titles your program will be training for your next step is to develop a tentative list of competency statements.

Step 2

Step #2: Locate Potential Competency (Task) Statements From As Many Appropriate Up-to-Date Sources As Possible.

Many schools, organizations and the military have probably already developed a competency listing for the specific occupation you are training for. This is not to say that you copy these materials exactly and base your entire curriculum on them, but in most cases this material will provide a starting point for you to work from. Samples and examples of such resources can be found in the resource section of this component. Now would be a good time to turn to the resource section of this component (page 118) and review some of the examples to give you a better understanding of what is being discussed and see what an actual task listing looks like.

Step 3

Step #3: Begin Generating an Overall Listing of the Actual Job Tasks Performed by Entry Level Workers Employed in the Job Titles Which Your Competency Listing Will Be Covering.

The job of generating an overall listing of the tasks performed by entry level workers is not as easy as it sounds. The first problem many instructors face is the ability to write task (competency) statements in clear, concise and objective terminology. Another problem faced by many is how specific should the task statements be. The following guidelines are some suggestions that have proven helpful to instructors who have developed tentative task listings.

1. Start with a clean slate at this stage of the competency identification process. Temporarily ignore the method you are using to teach. Forget about courses, units, semester, terms, sequences, etc. Make the assumption at this point in time that you have been charged with the task of setting up the program as it should be--not as it has to be to fit into the existing "system".

2. List only the actual "hands on" skills done on the job. Do not list tasks related to theory, knowledge, safety, terminology of the occupation, ethics, attitudes, or any other supporting or related information (these concepts will be covered later).

3. Assume that all theory, facts and knowledge related to a "hands on" task will be learned right along with that task.

4. Be very careful how each task statement is worded.

5. Only list entry level tasks. Do not list tasks that a technician with many years of experience would be expected to be able to perform.

Use Action Verbs

Make sure each competency statement begins with an action verb that indicates exactly what the worker is actually doing! Avoid ambiguous (subjective) phrases such as "have an understanding of", "have a knowledge of", etc. The lists of verbs on the following page should provide some help in choosing the correct verb to describe what a worker is actually doing.

APPLICATION

Apply
Care for
Carry out
Dispatch
Dispense
Effect
Employ
Give
Implement
Issue
Obtain
Process
Specify
Undertake
Use
Utilize

COLLECTION OF INFORMATION/THINGS

Collect
Detect
Gather
Locate
Obtain
Order
Procure
Requisition
Secure
Select

COMMUNICATION

Advise
Communicate
Convey
Disseminate
Inform
Interpret
Present
Read
React to
Recommend
Submit

CREATIVITY

Change
Conceive
Conceptualize
Create
Design
Develop
Devise
Formulate
Initiate
Modify
Originate
Revise

EVALUATION

Adapt
Appraise
Assess
Check
Evaluate
Inspect
Judge
Measure
Test

MAINTENANCE

Adjust
Align
Assemble
Install
Maintain
Manipulate
Operate
Repair
Service
Set up

MANAGEMENT

Administer
Arrange
Conduct
Contract
Control
Coordinate
Direct
Manage
Negotiate
Officiate
Organize
Oversee
Preside
Regulate
Resolve
Schedule
Supervise

RELATIONSHIPS

Assist
Cooperate
Follow
Help
Instruct
Lead
Participate
Teach

PROBLEM SOLVING

Analyze
Calculate
Determine
Diagnosis
Estimate
Examine
Plan
Propose
Research
Solve

PRODUCTION

Build
Complete
Construct
Duplicate
Execute
Fabricate
Form
Lay out
Make
Manufacture
Mount
Produce
Reproduce
Work

PERFORMANCE

Demonstrate
Display
Exhibit
Perform
Practice
Show

VERIFICATION AND SUPPORT

Establish
Justify
Prove
Record
Support
Verify

WRITING

Author
Compile
Compose
Correct
Draft
Draw
Edit
Illustrate
Prepare
Record

Agree on Meanings

All the instructors in a program need to agree what a particular action verb means (i.e. should it be "repair" or "troubleshoot"?). Many instructors have solved this problem by agreeing on the meaning of specific words and then printing a glossary of the most common action verbs used to describe activities in the program. Located on the following page is a sample of a glossary developed by Orange County Schools in Orlando, Florida.

GLOSSARY

Adjust	bring components to specified operational settings.
Check	verify proper operation; verify condition by performing an operational or comparative examination.
Diagnose	process of identifying the nature of a problem; locate the cause or nature of a problem by using specified procedures; establish that a problem exists.
Inspect	examine by sight, sound, and touch; verify condition by performing an operational or comparative examination.
Install	place a component in its proper position in a system.
Overhaul	disassemble, inspect, repair as necessary, and check.
Rebuild	disassemble, inspect, replace components as necessary, repair as necessary, and check.
Recondition	restore to original factory specifications by repairing, renovating, or rebuilding.
Remove and Replace	to take off an unserviceable component and put back with a new or rebuilt component; to reinstall a component.
Repair	correct a defective condition--includes component replacement and adjustment to include component repair when necessary; restore a malfunctioning component or system to operating condition.
Service	perform functions that assure continued operation; perform a specified procedure when called for in the owner's or service manual.
Test	verify condition through the use of meters, gauges, or instruments.
Troubleshoot	analyze and identify malfunctions.

Suggestions for Developing Task Statements

√ Avoid using unnecessary words. For example the statement "Demonstrate the ability to utilize the valve grinding machine" could be more accurately and more briefly stated as "grind valves."

√ Make sure that each competency statement describes some useful product or service (or major portion of a product or service) that an employer or customer would normally pay for. (Remember at this time we are limiting our competency statements to only those activities acutally done on the job.)

√ Each job task should have a definite beginning and ending point within a limited period of work time.

√ Tasks that take very little time to learn probably should be grouped with other related tasks. A training program should have very few if any one or two hour tasks. Most tasks in vocational technical programs at the post secondary level should take somewhere between five and twenty hours for completion (time to learn how to perform the task).

√ Many instructors have found it helpful to break task statements down into two or three components: action verb, performance object (what is used or produced) and a qualifier if applicable. Qualifiers are used to make task statements more specific. An example of this procedure can be found on the next page.

√ Review the sample task statements contained in the resource section of this component.

Components of Task Statements

Performance (Action Verb)	Object (What is Used or Produced)	Qualifier
Perform	a butt weld	in the overhead position
Solder	components	to a printed circuit board
Type	a letter	from dictation
Record	entries	for cash payment
Fabricate	joint	using PVC pipe
Calculate	cardiac outputs	
Type	alpha keys	20 wpm/2 min/40
Join	copper tubing	to steel pipe
Perform	macro. troubleshooting	of video system
File	materials	geographically
File	materials	by subject

The preceding text has offered many suggestions on how to write effective competency statements. It is also suggested that you review the resource section of this component. In this section you will find samples and examples of competency listings that are in actual use at various schools throughout the country as well as sources for obtaining competency listings.

After a tentative listing of tasks has been developed most instructors group similar tasks into categories or groupings called "duties". Basically a duty is a distinct major activity involved in performing a job and consists of a grouping of similar tasks. The following is an example of a duty statement.

Duty

Maintaining Refrigeration Systems

Tasks

1. Fabricate tubing
2. Solder refrigeration tubing
3. Trace refrigeration cycle
4. Determine pressure temperature relationships
5. Evacuate and charge a refrigeration system
6. Disassemble and reassemble a semi-hermetic compressor
7. Analyze refrigeration system components
8. Troubleshoot refrigeration electrical system

One suggestion that has proven helpful to many schools is to end the action verb in the duty statement with "ing". The major reason for doing this (adding ing) is to distinguish task statements from duty statements. At this time it is also recommended that tasks within the duty statement be organized in the order they are to be learned by students. Prerequisites need to be listed accordingly.

Once you have organized your tasks into duties and typed up a tentative list of tasks, it is highly recommended that you review this tentative listing with your advisory committee. They can provide you with valuable assistance. One word of caution is necessary at this time. Many instructors have been tempted to use existing course titles as duty statements to categorize tasks. Remember now to forget your existing course materials and structure and focus on generating a listing of what tasks are actually performed on the job.

Task Verification B-4

Step 4

Step 4: Refine Your Tentative Listing of Job Tasks, Organize Them into Meaningful Categories or Duties and Survey Individuals Who are Employed in the Occupation.

The purpose of Step #4 is to verify the tasks you are planning to teach are the actual competencies necessary for entry level employment. This process of verifying tasks is commonly called task validation. The survey that is sent out to workers in the field is called a task inventory questionnaire or survey. The length of your task inventory (number of tasks to be surveyed) will vary with the complexity of the occupation being surveyed.

Individuals who validate your task inventory should be the actual workers in that occupation or their direct supervisors. Avoid having too many supervisors, managers, owners, etc. respond to the survey because it might have been many years since these individuals have actually performed the tasks you are surveying.

Instructors should send task inventories to a representative sampling of typical employers or potential employers throughout the geographic area served by the school. Use of membership lists of trade organizations, classified advertisements of help wanted ads for the occupation you are training for and advice from your advisory committee members should provide a good source of individuals who are willing to complete the survey.

A question often asked by instructors is "How many surveys need to be sent out?". There is no correct answer to this question. The higher the number of surveys completed the more validity your task survey will have. (A minimum of 25 completed surveys is suggested.)

One goal every instructor should have is a high rate of task survey return. It is probably unrealistic to expect all the surveys you send out will be completed and returned. The following suggestions, if implemented, usually assure a higher rate of return;

* Call and discuss the survey before sending it. (Have individuals agree to complete the survey before sending it to them.)

* Include a cover letter explaining the purpose and importance of a prompt reply

* Make follow up telephone calls

* Include a self-addressed, stamped envelope for replies.

Many different types of task survey questionnaires are in use. (Examples are included in the resource section of this component.) Most schools eventually adopt a standardized format that is used by all programs in a school.

A standardized format of a task inventory survey adopted by Texas State Technical Institute Amarillo is included on the next several pages for your review. Page 93 contains a copy of the cover letter that was sent out with the survey to inform respondents of the purpose of the document. Page 94 contains information on how to fill out the form and discusses the rating system used to evaluate specific tasks. Page 95 contains some additional questions that are typically asked of people who complete the form. Pages 96 and 97 contain copies of the actual first two pages of the inventory.

TSTI AMARILLO

Texas State Technical Institute
Instructional Development Services
P.O. Box 11197
Amarillo, Texas 79111
(806) 335-2316 ext. 471

Dear

It is the goal of Texas State Technical Institute Amarillo to train qualified and competent workers. In order to accomplish this goal our training programs are designed around the skills required by Texas business and industry for entry level employees they hire.

TSTI Amarillo is now in the process of developing a new training program , Feedmill and Elevator Technology. Basically this program will train students in the skills necessary to maintain, operate and manage equipment and machinery used in the cattle feeding, feedmill and grain storage industries. Since your company hires feedmill and elevator technicians we want your input in exactly what skills should be taught that will best meet your needs.

I would appreciate it if you would complete the attached survey and return it to me in the self addressed stamped envelope as soon as possible. This is the same survey I discussed with you on the phone last week. If you have any questions please contact me.

Thank you for your valuable assistance in helping to assure that we are training our students in the skills they will need to become productive employees.

Sincerely,

TSTI

Feedmill and Elevator Technology Task Inventory

SCALES			
	Performed	-P	Circle one
	Not performed	-N	
	Low	-1	Circle one
	Medium	-2	
	High	-3	

Directions for Completing Task Inventory Survey

If a particular task is not performed in your business, please circle only "N" and go to the next question. If a task is performed, circle "P" and answer the "Frequency", "Importance", and "Difficulty" sections of the survey. Please use the following descriptions in marking your responses:

TASK FREQUENCY

1. Tasks rated low in frequency are usually performed once each month or less.
2. Tasks rated medium in frequency are usually performed once each week or less.
3. Tasks rated high in frequency are generally performed on a daily basis.

TASK IMPORTANCE

1. Tasks rated as having low importance are performed, but they are of minor importance and have a low priority.
2. Tasks rated as having medium importance are not critical, but they are often given priority over other tasks. Inadequate performance of this task CAN seriously impact product or service.
3. Tasks rated high in importance are critical and have the highest priority. Inadequate performance of this task WILL have serious impact on product or services.

TASK DIFFICULTY

1. Tasks having low difficulty rating are easy to perform, are of minimal complexity, and little practice is required to maintain competency.
2. Tasks rated medium in difficulty are complex, require considerable knowledge and must have practice to maintain competency.
3. Tasks rated high in difficulty are very complex, performed to exacting standards, and require continual practice in order to maintain competency.

Please add any items you wish in the blank spaces provided at the end of each section.

Once again we would like to thank you for completing this survey. We realize this takes a considerable amount of your valuable time, but it also assures that the Feedmill Elevator Technology program at TSTI will teach its students the skills and knowledge required by industry.

Feedmill and Elevator Technology Task Inventory

Name: ____________________

Address ____________________

Telephone No. ____________________

Company Title____________________

Type of Company____________________

Job or Position Title____________________

Number of Employees in this Position at this Site____________________

Total Number of Employees at this Site____________________

Total Years in Present Job or Position____________________

Total Years in Career Field____________________

Number of People Currently Supervised by You____________________

Date Survey Completed____________________

Do you plan to hire any additional entry-level technicians in the next two years?
(Circle one) Yes No

If answer to above question is yes, how many?________

Would you be interested in serving on our advisory committee?
(Circle one) Yes No

Duty	Task	Maintaining Electrical Equipment	P N	Frequency 1 2 3	Importance 1 2 3	Difficulty 1 2 3
A	01	Install simple electrical loads & switches	P N	1 2 3	1 2 3	1 2 3
A	02	Compute wire, conduit & electrical box sizes	P N	1 2 3	1 2 3	1 2 3
A	03	Troubleshoot over-current protection devices	P N	1 2 3	1 2 3	1 2 3
A	04	Troubleshoot single phase motors	P N	1 2 3	1 2 3	1 2 3
A	05	Troubleshoot three phase motors	P N	1 2 3	1 2 3	1 2 3
A	06	Troubleshoot electro-mechanical relays	P N	1 2 3	1 2 3	1 2 3
A	07	Troubleshoot solid-state relays	P N	1 2 3	1 2 3	1 2 3
A	08	Troubleshoot electro-mechanical motor starters	P N	1 2 3	1 2 3	1 2 3
A	09	Troubleshoot solid-state motor starters	P N	1 2 3	1 2 3	1 2 3
A	10	Troubleshoot simple electrical control circuits	P N	1 2 3	1 2 3	1 2 3
A	11	Troubleshoot complex multi-station control circuits	P N	1 2 3	1 2 3	1 2 3
A	12	Troubleshoot computer controlled control circuits	P N	1 2 3	1 2 3	1 2 3
A	13	Troubleshoot photoelectirc control circuits	P N	1 2 3	1 2 3	1 2 3
A	14	Troubleshoot reduced voltage starters	P N	1 2 3	1 2 3	1 2 3
A	15	Troubleshoot part winding start starters	P N	1 2 3	1 2 3	1 2 3
A	16	Troubleshoot timed or time delay control circuits	P N	1 2 3	1 2 3	1 2 3
A	17	Remove, repair or replace mechanical limit switches	P N	1 2 3	1 2 3	1 2 3
A	18	Remove, repair or replace proximity limit switches	P N	1 2 3	1 2 3	1 2 3
A	19	Remove, repair or replace level control devices	P N	1 2 3	1 2 3	1 2 3
A	20	Remove, repair or replace flow control devices	P N	1 2 3	1 2 3	1 2 3
A	21	Remove, repair or replace electric braking devices	P N	1 2 3	1 2 3	1 2 3
A	22	Remove, repair or replace electric clutches	P N	1 2 3	1 2 3	1 2 3

Duty	Task	**Maintaining Electrical Equipment (cont.)**	P	N	Frequency			Importance			Difficulty		
					1	2	3	1	2	3	1	2	3
A	23	Troubleshoot motors using a megohm meter (megger)	P	N	1	2	3	1	2	3	1	2	3
A	24	Troubleshoot electric circuits using a megohm meter	P	N	1	2	3	1	2	3	1	2	3
A	25	Operate, maintain & repair electronic weighing devices	P	N	1	2	3	1	2	3	1	2	3
A	26	Operate, maintain & repair electronic load cells	P	N	1	2	3	1	2	3	1	2	3
		Other:											
		Maintaining Mechanical Systems											
B	01	Align & tension a belt drive	P	N	1	2	3	1	2	3	1	2	3
B	02	Maintain belt drives	P	N	1	2	3	1	2	3	1	2	3
B	03	Construct belt joints using mechanical fasteners	P	N	1	2	3	1	2	3	1	2	3
B	04	Construct belt joints using adhesives	P	N	1	2	3	1	2	3	1	2	3
B	05	Install, align & tension a chain & sprocket drive	P	N	1	2	3	1	2	3	1	2	3
B	06	Maintain chain & sprocket drive	P	N	1	2	3	1	2	3	1	2	3
B	07	Maintain and align closed gear drives	P	N	1	2	3	1	2	3	1	2	3
B	08	Maintain gear drives	P	N	1	2	3	1	2	3	1	2	3
B	09	Install & align flexible couplings	P	N	1	2	3	1	2	3	1	2	3
B	10	Remove & replace a bearing seal	P	N	1	2	3	1	2	3	1	2	3
B	11	Remove & install a mechanical seal	P	N	1	2	3	1	2	3	1	2	3
B	12	Remove & replace packing ina stuffing box	P	N	1	2	3	1	2	3	1	2	3
B	13	Align pillow blocks and bearings	P	N	1	2	3	1	2	3	1	2	3
B	14	Install pillow block bearings	P	N	1	2	3	1	2	3	1	2	3
B	15	Remove & install rolling element bearings	P	N	1	2	3	1	2	3	1	2	3

Two items that probably need further clarification concerning the preceding examples (FET Task Survey) are the numbering system and the "other" statement found at the end of each duty statement. Texas State Technical Institute Amarillo has arbitrarily decided to use letters (A, B, C, etc.) to signify duties and numbers (1, 2, 3, etc.) to signify tasks. For example, Task B-14, Install Pillow Block Bearings is a task in the B Duty category, Maintaining Mechanical Systems.

Also notice at the end of each duty category there is a place on the survey titled "other". This space (other) allows respondents to add additional tasks that might have been overlooked in the original design of the survey but are important to that particular employer.

Step 5

Step #5: Analyze the Results of the Task Verification Process. After you receive the completed task inventory your next step is to tabulate the responses. Many schools are now using computers to assist with this task. Any of the popular data base programs available for personal computers can be set up to tabulate data. Use of these programs will decrease your work time substantially. The results of the sample FET task inventory Duty A are on the following pages. An explanation of the rating system will follow.

Duty	Task	Maintaining Electrical Equipment	P N	Frequency 1 2 3	Importance 1 2 3	Difficulty 1 2 3
A	01	Install simple electrical loads & switches	29 6 P N	1.27 1 2 3	2.08 1 2 3	1.57 1 2 3
A	02	Compute wire, conduit & electrical box sizes	12 23 P N	1.06 1 2 3	1.89 1 2 3	1.90 1 2 3
A	03	Troubleshoot over-current protection devices	14 21 P N	1.76 1 2 3	2.86 1 2 3	2.24 1 2 3
A	04	Troubleshoot single phase motors	23 12 P N	1.27 1 2 3	2.09 1 2 3	1.76 1 2 3
A	05	Troubleshoot three phase motors	25 10 P N	1.68 1 2 3	2.46 1 2 3	1.83 1 2 3
A	06	Troubleshoot electro-mechanical relays	19 16 P N	1.53 1 2 3	2.24 1 2 3	1.94 1 2 3
A	07	Troubleshoot solid-state relays	7 28 P N	1.29 1 2 3	2.56 1 2 3	2.29 1 2 3
A	08	Troubleshoot electro-mechanical motor starters	19 16 P N	1.52 1 2 3	2.41 1 2 3	2.21 1 2 3
A	09	Troubleshoot solid-state motor starters	12 23 P N	1.08 1 2 3	1.82 1 2 3	1.57 1 2 3
A	10	Troubleshoot simple electrical control circuits	23 12 P N	1.52 1 2 3	2.23 1 2 3	2.06 1 2 3
A	11	Troubleshoot complex multi-station control circuits	12 23 P N	1.67 1 2 3	2.49 1 2 3	2.40 1 2 3
A	12	Troubleshoot computer controlled control circuits	7 28 P N	1.11 1 2 3	2.83 1 2 3	2.69 1 2 3
A	13	Troubleshoot photoelectirc control circuits	3 32 P N	1.00 1 2 3	2.00 1 2 3	1.67 1 2 3
A	14	Troubleshoot reduced voltage starters	9 26 P N	1.09 1 2 3	1.76 1 2 3	1.64 1 2 3
A	15	Troubleshoot part winding start starters	5 30 P N	1.20 1 2 3	1.00 1 2 3	1.20 1 2 3
A	16	Troubleshoot timed or time delay control circuits	11 24 P N	1.27 1 2 3	2.44 1 2 3	2.18 1 2 3
A	17	Remove, repair or replace mechanical limit switches	21 14 P N	1.13 1 2 3	2.05 1 2 3	1.63 1 2 3
A	18	Remove, repair or replace proximity limit switches	14 21 P N	1.00 1 2 3	2.00 1 2 3	1.33 1 2 3
A	19	Remove, repair or replace level control devices	20 15 P N	1.20 1 2 3	2.20 1 2 3	1.92 1 2 3
A	20	Remove, repair or replace flow control devices	15 20 P N	1.20 1 2 3	2.31 1 2 3	1.87 1 2 3
A	21	Remove, repair or replace electric braking devices	10 25 P N	1.08 1 2 3	2.17 1 2 3	1.58 1 2 3
A	22	Remove, repair or replace electric clutches	4 31 P N	.75 1 2 3	2.25 1 2 3	1.50 1 2 3

Duty	Task	Maintaining Electrical Equipment (cont.)	P N	Frequency 1 2 3	Importance 1 2 3	Difficulty 1 2 3
A	23	Troubleshoot motors using a megohm meter (megger)	12 23 P N	1.32 1 2 3	1.86 1 2 3	1.76 1 2 3
A	24	Troubleshoot electric circuits using a megohm meter	13 22 P N	1.86 1 2 3	2.37 1 2 3	2.23 1 2 3
A	25	Operate, maintain & repair electronic weighing devices	13 22 P N	1.38 1 2 3	2.61 1 2 3	2.30 1 2 3
A	26	Operate, maintain & repair electronic load cells	9 26 P N	1.22 1 2 3	2.76 1 2 3	2.44 1 2 3
		Other:				
		Maintaining Mechanical Systems				
B	01	Align & tension a belt drive	P N	1 2 3	1 2 3	1 2 3
B	02	Maintain belt drives	P N	1 2 3	1 2 3	1 2 3
B	03	Construct belt joints using mechanical fasteners	P N	1 2 3	1 2 3	1 2 3
B	04	Construct belt joints using adhesives	P N	1 2 3	1 2 3	1 2 3
B	05	Install, align & tension a chain & sprocket drive	P N	1 2 3	1 2 3	1 2 3
B	06	Maintain chain & sprocket drive	P N	1 2 3	1 2 3	1 2 3
B	07	Maintain and align closed gear drives	P N	1 2 3	1 2 3	1 2 3
B	08	Maintain gear drives	P N	1 2 3	1 2 3	1 2 3
B	09	Install & align flexible couplings	P N	1 2 3	1 2 3	1 2 3
B	10	Remove & replace a bearing seal	P N	1 2 3	1 2 3	1 2 3
B	11	Remove & install a mechanical seal	P N	1 2 3	1 2 3	1 2 3
B	12	Remove & replace packing ina stu[illegible] box	P N	1 2 3	1 2 3	1 2 3
B	13	Align pillow blocks and bearings	P N	1 2 3	1 2 3	1 2 3
B	14	Install pillow block bearings	P N	1 2 3	1 2 3	1 2 3
B	15	Remove & install rolling element bearings	P N	1 2 3	1 2 3	1 2 3

Explanation of Data

Duty	Task	Maintaining Electrical Equipment	P	N	Frequency 1 2 3	Importance 1 2 3	Difficulty 1 2 3
A	01	Install simple electrical loads & switches	29	6	1.27	2.08	1.57

A total of 35 individuals completed the survey; 29 stated task A01 was performed at their location, 6 said it was not.

1.27 is the average rating for the frequency that the task is performed by the 29 individuals who perform the task. This task is performed little more than once each month. (See page 94 for explanation of rating system.)

2.08 is the average rating for the importance of this task. This task is rated as having medium importance but inadequate performance of this task can seriously impact product or services.

1.57 is the average rating for the difficulty of performing this task therefore this task is rated between low and medium in difficulty of performing.

Step 6

Step #6: Add Any Necessary Knowledge or Theory Tasks to the Task Listing

Many occupations are governed by licensing, accrediting or certifying agencies (i.e. aircraft mechanics, nursing, cosmetology, etc.). It is mandatory that any prerequisites that these agencies require be included on your task listing.

Programs offering associate degrees must meet the standards established by a regional accrediting agency (Southern Association of Colleges and Universities) and therefore include specific tasks to meet these accreditation requirements.

You have probably noticed that throughout the discussion of the competency identification and validation process that most of the task statements were based on "hands on" activities or skills. This resource guide is suggesting that related knowledge, theory, terminology, etc. be learned in conjunction with the particular task it is being used with. Therefore most theory or knowledge activities would not be listed as a distinct task on the program's task listing, but would appear as enabling objectives within a task. (enabling objectives will be explained in the next component of the Resource Guide).

Knowledge Tasks

Occasionally there are broad or general areas of theory or knowledge that are relevant to a number of skill tasks. Sometimes there may be concepts that are so complex they have to be treated as stand alone tasks. Examples of such tasks would be:

- * Describe major components and operation of air induction system
- * Trace the flow of blood through the circulatory system

Notice that these "theory" competencies also begin with an action verb and clearly describe what a student must be able to accomplish to demonstrate mastery.

Theory tasks should be worded just as objectively and precisely as skill tasks. It is recommended to keep the number of "theory" tasks on the official program task listing to a minimum. Theory tasks should only be added when absolutely necessary. It is more educationally sound if a student learns theory or knowledge along the way, interwoven into instruction for skill tasks. Avoid grouping "theory tasks" into a separate duty statement, but sequence them in the task listing where they should logically go.

In many cases it is necessary to add competencies that are neither skill or theory tasks (related to a specific skill task). This is especially true in such areas as math, science, English and employability skills. Examples of such tasks could include:

* Convert fractions to decimals

* Solve right triangle problems for missing value

* Accept supervision positively

* Maintain safe and neat work area

* Fill out a job application

* Participate in a mock job interview

Again, just as with skill and theory competencies, these statements should begin with an action verb and clearly describe what the student will do to show mastery. Often these type of tasks appear in separate duty statements. The following is an example (several additional examples can also be located in the resource section of this component) of this type of task.

Duty — **Performing employability skills**

Tasks

Complete steps in the employment seeking process.

Recognize positive job attitudes.

Solve human relations problems.

Duty — **Demonstrating grammar skills**

Tasks

Indicate and use prepositions and conjunctions in sentences.

Construct simple compound and complex sentences.

Use capital letters in sentences.

Punctuate sentences.

Use pronouns in sentences.

Use verbs in sentences.

Choose adjectives and adverbs in sentences.

There is one more step to perform after tasks have been written in the correct format and organized into related duties. All tasks should then be ranked.

The survey document (Feedmill and Elevator Technology, page 96) that was used as a sample in this component of the Resource Guide incorporated a rating system that asked whether or not the task was actually performed on the job; how frequently it was performed; how important the task was in relation to a product or service and how difficult it was to learn the task.

The following list (on the next page) is a ranking of the tasks listed in Duty A of the Feedmill and Elevator Technology survey in order of percentage performed. Each number in the "frequency", "importance" and "difficulty" columns is an average based on the responses from the survey.

FET TASK INVENTORY

Duty	Rank	Task	Description	% Perform	Frequency	Importance	Difficulty
A	MAINTAINING ELECTRICAL EQUIPMENT						
A	1	01	install simple electrical loads & switches	83%	1.27	2.08	1.57
A	2	05	troubleshoot three phase motors	72%	1.68	2.46	1.83
A	3	04	troubleshoot single phase motors	66%	1.27	2.09	1.76
A	3	10	troubleshoot simple electrical control circuits	66%	1.52	2.23	2.06
A	4	17	remove, repair or replace mechanical limit switches	60%	1.13	2.05	1.63
A	5	19	remove, repair or replace level control devices	57%	1.20	2.20	1.92
A	6	06	troubleshoot electro-mechanical relays	54%	1.53	2.24	1.94
A	6	08	troubleshoot electro-mechanical motor starters	54%	1.52	2.41	2.21
A	7	20	remove, repair or replace flow control devices	43%	1.20	2.31	1.87
A	8	03	troubleshoot over-current protection devices	40%	1.76	2.86	2.24
A	8	18	remove, repair or replace proximity limit switches	40%	1.00	2.00	1.33
A	9	24	troubleshoot electric circuits using a megohm meter	37%	1.86	2.37	2.23
A	9	25	operate, maintain & repair electronic weighing devices	37%	1.38	2.61	2.30
A	10	02	compute wire, conduit & electrical box sizes	34%	1.06	1.89	1.90
A	10	09	troubleshoot solid-state motor starters	34%	1.08	1.82	1.57
A	10	11	troubleshoot complex multi-station control circuits	34%	1.67	2.49	2.40
A	10	23	troubleshoot motors using a megohm meter (megger)	34%	1.32	1.86	1.76
A	11	16	troubleshoot timed or time delay control circuits	31%	1.27	2.44	2.18
A	12	21	remove, repair or replace electric braking devices	29%	1.08	2.17	1.58
A	13	14	troubleshoot reduced voltage starters	26%	1.09	1.76	1.64
A	13	26	operate, maintain & repair electronic load cells	26%	1.22	2.76	2.44
A	14	07	troubleshoot solid-state relays	20%	1.29	2.56	2.29
A	14	12	troubleshoot computer controlled control circuits	20%	1.11	2.83	2.69
A	15	15	troubleshoot part winding start starters	14%	1.20	1.00	1.20
A	16	22	remove, repair or replace electric clutches	11%	.75	2.25	1.50
A	17	13	troubleshoot photoelectric control circuits	9%	1.00	2.00	1.67

Reasons for Ranking Tasks

Depending on the rating system being used on a particular survey instructors need to "rank" tasks in some logical order. This will assist training programs in determining what tasks should be emphasized or taught.

Once you have ranked tasks you will then be able to better determine what tasks should be included on your finalized task listing. Your final task listing will be a list of the tasks that will be taught in your training program. For example, if a task is not performed on the job (low percentage performed number), not important and difficult to learn; this task should probably not be included on your finalized listing.

There is no formula or "cut off" point for determining what tasks should be included on the final listing. Each individual training program will have to evaluate additional factors such as time and expense when considering whether or not to include "marginal" tasks in their curriculum. Tasks that are performed on the job frequently and are important (as indicated by the survey) should definitely be included.

Instructors need to be careful in their analysis of survey data. A particular task could have a very low "percentage performed" number and it could seem obvious at first observation this skill should not be taught. For example, if a training program sent out 25 surveys and only one of the returned surveys indicated that a particular task was performed on the job while the other 24 indicated that this task was not performed; this type of score (4% perform, 96% not perform) would seem to indicate that this particular skill should not be included on the program's task listing. Upon further investigation it was discovered that this one company was a large local employer and planned to hire several hundred entry level technicians in the near future while the other 24 firms (who said the task was not performed) planned to employ only a few graduates.

Many factors need to be considered in making decisions in determining what tasks are to be included on a training program's official task listing. Careful evaluation of survey data will greatly assist instructors.

Artificial Tasks

There are a few points to keep in mind as you develop and finalize your program task listing. As already mentioned, you may have to add several tasks (both theory or skill)to your program listing because these tasks are required for licensing, certification, accreditation etc. Many times these "required" tasks are often outdated or no longer used. These "artificial" tasks, although not needed for performing a job competently, will have to be added to the training program because students are requested to successfully pass an entrance examination to be eligible to work in certain professions.

Refinement

A good task listing is really never finalized. You will want to or even be required to update and refine it periodically. Many schools have discovered that an annual task reverification is useful to identify any tasks that need to be added, deleted or refined due to changing technology in the work place. Many training programs perform this yearly update on a portion of their task listing. For example, in an electronics program most of the AC and DC theory and application tasks will remain the same year after year while tasks dealing with microprocessors might have to be constantly updated.

Do not be overly concerned with the sequence of your task listing. List tasks in some logical order within each duty statement. Another document which is called a "task map" will illustrate the exact sequence students are to follow in learning tasks. This document (task map) is not difficult to develop and will be explained in a later component of this resource guide.

Once you have finalized and organized all your tasks into duties and typed them into a task listing it is highly recommended that you have your advisory committee perform a final review.

No mention of courses has been made up to this point in the Resource Guide. The emphasis has been focused exclusively on generating an up-to-date, validated and performance based task listing. Although it may not be possible or practical for schools to "drop" courses the ideal situation in which to implement competency-based mastery learning is to eliminate or at least de-emphasize courses and focus exclusively on competencies.

Are Courses Necessary?

Several schools in the United States and Canada have "dropped" courses and their curriculums are based entirely on a task listing. The elimination of courses in a vocational technical environment has the following benefits:

* The focus of the training program shifts from courses to competencies. Competencies are what will be of value to an employer.

* The practice of having seperate lab courses and seperate theory courses is avoided. Theory is taught exactly when it is needed to assist in the performance of a specific skill.

* Self pacing, flexible entry/exit and time flexible learning are greatly enhanced when courses and their rigid time frames no longer "drive" the system.

* Training programs can be custom made to fit the needs of individual students, groups and companies.

The elimination of courses may not be as impossible as it sounds especially for programs that lead to a certificate and not an associate degree. Students would simply apply for, enroll in, pay fees for, progress through and finally exit from a program or a portion of a program rather than a series of course.

The first sentence in the preceding paragraph stated that it would not be impossible to drop courses. It did not say that it would be simple. Cooperation would be needed with many other entities on a campus, especially the registrar, the financial aid office and the business office. Since most vocational technical programs in Texas are funded on a contact hour basis that is based on enrollment in courses, special provisions would have to be made.

It is probably unrealistic at this time for many schools to consider "dropping" courses and basing training programs totally on a task listing. In most educational institutions courses will be a "given". Competency-based education can easily be adapted to a "course structure". This concept will be discussed in the next component of the Resource Guide.

Once you have completed your "finalized" task listing (remember a task listing is really never finalized since it is changed and updated periodically) compare your task listing with the content of the courses you are currently teaching. It is critical that courses fit the competencies and not make competencies fit the courses. After you have completed this comparison some courses will probably have to be changed or dropped altogether. Changes instructors usually have to make to assure that courses "fit" competencies, include:

* **Completely eliminating some courses entirely**--particularly courses covering tasks rated as "unimportant" during the competency verification process.

* **Combining theory and lab courses.** The traditional approach may have been to conduct a "theory" course during the Fall term and a "lab" course on the practical application of the theory during the Winter term. These two courses might be combined to develop two new courses where both theory and practical application are taught in each. The net result would be two courses with the same credit hours, the same enrollment and the same faculty teaching load specifications.

* **Retitling or renaming course:** course names might be changed to more accurately reflect the specific competencies (duty) area the course is covering.

* **Developing courses of different time lengths.** Traditionally most courses are three credits and last a full semester. If your training program ends up with a small cluster of specialized related competencies, these competencies could be grouped into a "short" course of one or two credit hours. A longer list of competencies that should be taught together may "fit" into: a five or six credit hour course. This process helps eliminate courses that contain a lot of "filler" that is often used just to stretch activities over a complete semester.

* **Adding new courses:** Additional courses may have to be added to teach required competencies as indicated by the task inventory.

* **Resequencing courses:** Sometimes courses have to be resequenced to more accurately teach specified competencies.

Final Thought

As you go through the competency identification and validation process, just keep in mind that *the primary focus of your program should be providing students with the skills they will need to function effectively on the job.* There are several examples of task listings included in the resource section of this component. One item that you will probably notice on many of the sample task listings is a column for "standard hours" or "hours". Standard hours or hours refer to actual time it takes the "average" student to cover the material and pass the performance test for a specific task.

Writing Performance Objectives

B-5

Once a task listing has been formalized, performance objectives need to be developed for each task on the task listing. A performance objective is a statement which describes what the learner must do to demonstrate mastery of a task. All performance objectives include three basic components: (1) Conditions, (2) Behavior and (3) Standards.

Condition

The **condition** component of a performance objective informs students of what will be available or any other conditions or restrictions that will be imposed when the student is demonstrating mastery of a task. The "condition" component of an objective can also describe what equipment, tools, supplies or resources the student will be given to work with; any items the student will not have access to; the environment or setting where the task must be performed and/or what information the student may be provided that will direct the action in a certain way. Some examples of condition statements are:

1. Given a set of blueprints
2. Without the aid of a calculator
3. Using a case study provided by the instructor
4. Given a malfunctioning carburetor
5. While in the hospital

Behavior

The **behavior** component of a performance objective is basically a restatement of the actual task from the program's task listing. This statement identifies the performance or behavior which a student will be required to demonstrate. The "behavior" component of a performance objective should be precise, observable and measurable.

Standard

The third component of a performance objective is called the **standard or criterion**. The standard tells students the quantity and quality of how they are expected to perform the task. There are several ways in which the standard can be established including (1) specification of tolerance limits (2) speed (3) maximum number of permissible errors (4) reference to other materials which specify standards (5) degree of excellence or (6) any combination of the above. All standards should be based on the actual performance level needed on the job.

The following three pages contain examples of performance objectives. These samples where included in Module B-2, Develop Student Performance Objectives (Performance-Based Teacher Education Modules).

CONDITION STATEMENTS

CATEGORY	EXAMPLES OF CONDITIONS
Equipment, supplies, or materials which the student is given to work with	• Having available all equipment within the electronics laboratory . . . • Given a set of blueprints . . . • Provided access to all references and materials in the DE store . . . • Given a list of performance objectives . . . • Using curriculum guides which provide program content information . . .
Materials to which the student is denied access	• Without aid of references . . . • Using only those materials provided . . . • Having available only that equipment which has been set up . . .
Environment in which the performance must be demonstrated	• In an actual school situation . . . • In a simulated classroom or laboratory situation . . . • While in the hospital or nursing home . . . • Using the fully functioning school auto mechanics laboratory . . .
Information that the student may be provided that will direct the action in a certain direction	• Given a written situation involving a family with ethnic eating patterns . . . • Provided two lists-one of terms and another of definitions . . . • Using a case study provided by the teacher . . .
Specification of the time in which the performance should be accomplished	• Upon completion of the course in sales . . . • After completing the required reading . . .

CRITERION STATEMENTS

GENERAL CATEGORY	EXAMPLES OF CRITERION
Accuracy within a tolerance limit	• within ± .1 degree as compared with the instructor's reading • with a tolerance of ± .001 inch as measured by a micrometer
Speed	• completed within five minutes • ready for return to the customer within 24 hours of drop off
Percent or number to be achieved	• with 80% correct responses • two out of the three items must meet criteria for the "finished product" • all information necessary for a dental history is recorded • at the rate of five per hour
Reference to other material which identifies specific criteria	• as compared to the manufacturer's specifications • using the evaluation guide which outlines specific criteria for table setting • according to class handout in communication skills • according to the criteria outlined in the text • according to office procedures • based upon the criteria specified in the assessment instrument
Maximum number of permissible errors	• with no more than two errors • with no more than one of the total items not meeting "standards" • missing no more than one reading/recording withing a two hour period

CRITERION STATEMENTS (Continued)

Degree of excellence	• so that the shine will reflect a piece of paper • such that the seam will not split when the two pieces of material are jerked sharply • so that when the weld is submitted a stress machine it will withstand 100 pounds of pressure • all criteria must be achieved at the good or excellent level • with no hair visible in the operating field
Or any combination	• the above criteria can be combined to further define the level of achievement necessary

Bloom's Taxonomy

There are different kinds as well as different levels of objectives. Benjamin Bloom in his book "Taxonomy of Educational Objectives" has classified objectives into three domains. The three domains identified by Bloom are:

A. Cognitive Domain - Knowledge, thinking, understanding and problem solving objectives are included in this domain.

B. Psychomotor Domain - Skill performance and "hands on" manipulative objectives are included in this domain.

C. Affective Domain - Attitude, emotion, values clarification, and appreciation objectives are included in this domain.

The categories for classifying objectives in each domain are arranged in a hierarchical order from the simplest to the complex. (The hierarchy of each domain is included in the resource section of this component.)

Most instructors have discovered that the performance objectives developed from their program task listings will be in the higher levels for all three domains. Rapidly changing technology requires today's vocational technical students to understand concepts, apply principles and solve problems (analyze, synthesize, evaluate).

Each component of this manual includes a resource section. Resource Section B contains information on validating student competencies.

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Implementation of Competency-Based Vocational Education-Questions to Consider

Illinois is recognized as one of the leaders in competency-based education. The Competency-Based Individualized Vocational Educational Consortium (CIVEC) has developed a series of self-instructional teacher training manuals. The following information was contained in one manual of the series (Task 015). It is a list of questions that need to be answered by administrators who are considering CBE adoption.

Implementation of Competency Based Vocational Education

Questions to Consider

Overall Approach to CBVE

1. What will the CBVE program be officially called at your institute or in your region?
2. Who will have the primary responsibility for heading up the CBVE efforts?
3. How will instructors and staff provide input into the CBVE program design?
4. What known constraints or limitations presently exist in your institution or region?
5. How will the policy decisions on the CBVE efforts be made?
6. How will information about other CBVE programs be gathered and used?
7. Who will have the primary responsibility for designing the CBVE program?
8. Will the competency-based approach be phased-in, or will your institution jump right in?
9. What approach to curriculum will be taken during the first year or two of operation or transition?
10. Will learning packages be used as the primary means of delivering instruction or as a supplement?
11. Will learning guides, modules, or something else be used to deliver instruction;what will they be called; how will the format be designed?
12. Will one format for learning packages be adopted throughout the entire institution, or can each department or program use its own?
13. Will learning resources be purchased, produced in-house, or both; if several media formats are available, which one will be used; will one type of audio visual equipment be used in all programs or several?

Program Structure for CBVE

1. When will students be able to enroll in programs?
2. When will students be able to exit as successful program completers?
3. How will sub-occupations within the total program be identified?
4. Will training programs be divided into courses or treated as total programs?
5. How will advanced placement for experienced students within programs be handled?
6. How will licensing requirements be reconciled with the CBVE program?
7. Will all students follow the same sequence of competencies, or will students be able to select the next competency if all prerequisites have been met?
8. How will students be shown multiple starting points, prerequisite tasks, recommended sequences, and multiple exit points?
9. Will students be allowed, encouraged or required to master one competency before going to the next?
10. Can a student begin a new task alone, only as a part of a small group, without instructor approval, only on certain days?
11. How will each individual student's training plan be determined and recorded?
12. How will each student's work be planned, how often, and how will it be recorded?
13. How will students be monitored to identify those that are having learning difficulties?
14. Can a student have access to learning materials days, evenings, weekends, holidays?
15. Will "mastery" be defined as being competent in performing a task at a high level of proficiency, or will "minimum competence" be acceptable?
16. Can each program establish its own minimum criteria for mastery of tasks, or will the criteria level be the same throughout the institution; will 100% mastery be required?
17. Will students each get a copy of each learning package, or will only a limited number be produced; will students purchase the learning packages, or will they be furnished?
18. Will media, materials, and equipment be housed in each program area, in each wing of the facility, or in a central location?

Identification of Occupational Competencies

1. Who will have primary responsibility for developing the list of occupational competencies for a program?
2. How will program competencies be locally verified?
3. How often will competencies be reviewed and revised for a program?
4. What will the outcomes you wish students to master be called--competencies, tasks, skills, goals, or something else?
5. How will student competencies be identified for each training program--observing incumbent workers, using catalogs of tasks, instructor-developed and worker-verified task lists, or other strategies?
6. At what level will competencies be written: at the job task level, subtask level, or broad goal level?
7. How will the student competencies for each program be listed and made available to students and others; what will this list be called?
8. Will competencies be "fit" into existing program lengths or will program lengths be based on the average time it takes students to master all required competencies successfully?
9. Will competencies be fitted into existing courses or units, or will students simply be enrolled in a "program"?
10. Will a student in a program be trained for the same occupation, or will they be given the option to specialize?
11. Will there be a separate list of competencies for each specialized occupation offered within the program?
12. Will there be a "core" of required competencies for all students regardless of specialization chosen?

Instructional Delivery

1. How will personalized student programs be designed?
2. How will laboratory and drill time be provided?
3. How will average time for achievement of each competency be computed?
4. How will individual, small-group, and large-group instruction be organized?
5. How will clinical experiences be organized and delivered?
6. How will field experiences be organized and delivered?
7. Will all students be required to master several basic tasks at the beginning of each program?
8. After the basics are mastered, will there be multiple starting points in those programs where this is feasible?
9. Who is the intended student population, and what are their characteristics?
10. How will recruitment, admissions, guidance, and counseling be handled?
11. How will waiting lists for programs be maintained?
12. How often will new students be allowed to enroll-weekly, bi-weekly, monthly?
13. Will new students be screened for certain essential prerequisites, or will the program focus entirely on exit competencies?
14. How will remediation of missing essential prerequisites be handled?
15. How will new students be steered toward training programs for which their chances of success are greatest.
16. How will new students be oriented to the competency-based learning system?
17. Will orientation be done in a central location, in each program area, or both?
18. Will instructor-student ratios be less, the same, or greater than in the traditional approach?

Instructional Materials

1. How will instructional materials and media be acquired?
2. Will a common learning guide format be used for all programs?
3. How will the purchase of instructional materials be organized?
    A. How will outside sources be located?
    B. How will materials be evaluated and selected?
    C. Will materials be adapted or used as is?
    D. How will purchase costs be covered?
4. Who will assume the day-day responsibility for supervising the development of learning materials; will that person(s) be freed form normal administrative/supervisory chores to focus entirely on curriculum?
5. Who will be required to develop learning packages--volunteers, lead instructors, or everyone; what about those who refuse to or are not capable of developing packages.
6. On whose time will instructors develop learning packages and resources--the instructors', the schools', or both; will instructors be paid extra--if so, how much, and from what source; who will own the learning packages and supporting media?
7. Who will field-test, evaluate, and revise learning packages; when and how; who will evaluate existing and newly developed programs and by what criteria?
8. Who will do the typing, editing, drawing, filing, copying, photographing, and other activities needed to support the development of learning guides and media; how will they be paid for?
9. Who will provide technical assistance for developing media, materials, learning packages, task listings, rearranging facilities, and developing management?

Student Assessment Procedures

1. What will be the relationship of testing for cognitive knowledge and assessment of technical performance in each program?
2. What student assessment procedures will be used?
3. How will standards of acceptable performance be set?
4. Who will develop performance tests for each competency?
5. Who will develop specific criteria for performance of each competency?
6. What will be the format for the assessment instruments?
7. What form of checklist or rating scale will be used to evaluate each competency?
8. How will situations and materials for performance testing be provided?
9. Will students be allowed to test out of packages; if so, how will this be handled and recorded?
10. How many times and how frequently will students be required to perform each competency to be considered competent?

Reporting Student Progress and Achievement

1. Who will certify achievement of each competency by each student?
2. How will achievement of each competency be reported? Will grades be issued? If yes, when and how will this be done?
3. How will students be kept informed and advised about their progress? How will unsatisfactory progress be defined and reported; what are the consequences?
4. What "grading" system will be used to report student achievement?
5. How will permanent records of students achievement be organized and maintained. Will records be kept manually or will computerized equipment be used?
6. If computers are used, what backup information will be maintained?
7. How will mastery of competencies be evaluated, certified, and documented?
8. How will employers and others be shown exactly what competencies each enrollee has mastered?

Administration of Programs

1. How will student registration and enrollment be handled?
2. What will be the tuition and fee schedule?
3. How will students be oriented to the CBVE approach and to the institution?
4. How will teaching loads and other instructor responsibilities be modified to meet the needs of CBVE?
5. How will part-time instructors be involved in the CBVE program?
6. What form of competency transcript will be given to program leavers and completers?
7. How will program completers and leavers be reported?
8. Where will additional funds for CBVE start-up costs be found?
9. Who will see to it that rules, policies, procedures, schedules, fees, records, publications, management strategies, budgets, forms reports, and related components all support competency-based learning?

Preparation of Personnel for CBVE

1. Who will be responsible for designing and delivering staff development activities?
2. How will faculty and staff be given initial information about CBVE?
3. How will essential competencies for instructors and others be identified?
4. What materials will be developed to help prepare faculty for CBVE?
5. Who will assist faculty as they encounter specific problems in implementing CBVE?
6. What outside assistance will be made available to faculty and staff preparing to implement CBVE?
7. How will the first programs to implement CBVE be selected?
8. Who will be the driving force behind the effort; who will be willing to publicly support the competency-based approach; who will provide the overall leadership for directing the implementation effort; whose support will be sought, and how?

Provision of Physical Facilities

1. Who will be primarily responsible for adapting physical facilities for CBVE programs?
2. What will be the scope of changes made in existing facilities?
3. How will resource centers be provided for each program?
4. How will resource centers be managed and staffed?
5. What additional audio visual equipment will be needed for CBVE programs?
6. What kinds of micro computers or terminals will be needed, if any?
7. Where will instructor work stations be located?
8. Will separate stations be set up for presentations, practice, and testing; if so, how, where, and when?

B-6

DACUM

DACUM (Developing A Curriculum) is a method used to analyze occupations by using input from expert workers to list specific tasks that are essential for successful job performance. The Coordinating Board has sponsored (Feb., 1987) a DACUM Facilitator's Workshop resulting in several certified facilitators throughout Texas. The following information was obtained from the DACUM Facilitator's Handbook and describes the DACUM process.

WHAT IS DACUM?

DACUM or "Developing A Curriculum" is a relatively new and innovative approach to occupational analysis. It has proven to be a very effective method of quickly determining, at relatively low cost, the tasks that must be performed by persons employed in a given job or occupational area.

The profile chart that results from the DACUM analysis is a detailed and graphic portrayal of the duties and tasks involved in the occupation or job being studied. The DACUM analysis can be used as a basis for (1) curriculum development, (2) student counseling and recruitment, (3) training needs assessments, (4) worker performance evaluations, (5) competency test development, and (6) job descriptions.

DACUM has been successfully used to analyze occupations at the professional, technical, skilled, and semiskilled levels. DACUM operates on the following three premises:

1. Expert workers are better able to describe/define their job than anyone else.

2. Any job can be effectively and sufficiently described in terms of the tasks that successful workers in that occupation perform.

3. All tasks have direct implications for the knowledge and attitudes that workers must have in order to perform the tasks correctly.

A carefully chosen group of eight to twelve expert workers from the occupational area under consideration form the DACUM committee. Committee members are recruited directly from business, industry, or the professions. The committee works under the guidance of a facilitator for two to three days to develop the DACUM chart. Modified small-group brainstorming techniques are used to obtain the collective expertise and consensus of the committee.

Because of their current occupational expertise, committee participants do not need any advance preparation. Almost without exception, participants on DACUM committees have found the activity to be a professionally stimulating and rewarding experience.

The DACUM committee is carefully guided by the facilitator through each of the following steps:

1. Orient committee to DACUM
2. Review job or occupational area of concern
3. Identify the general areas of responsibility (duties)
4. Identify the specific tasks performed in each duty area
5. Review and refine task and duty statements
6. Sequence task and duty statements
7. Identification of entry-level tasks
8. Other options, as desired

The DACUM process usually results in the identification of 8 to 12 duties and 50 to 200 task statements that outline what a successful worker in a particular job or cluster of related jobs must be able to do. These tasks are then commonly submitted to a larger but still select group of workers and/or the immediate supervisors of such workers for verification purposes.

The tasks that are verified as important become the research base for developing modules or other units of instruction for the educational program. During the instructional development phase that follows the DACUM process, the verified tasks undergo a task analysis to determine the specific skills, knowledge, and attitudes the worker needs to perform each task. The information resulting from the task analysis is then incorporated into modules, learning guides, or other types of instructional materials for student and teacher use.

DACUM is particularly well suited for educational institutions and training agencies that are implementing or are planning to implement competency-based education (CBE) or training programs since the first essential step in any CBE program involves the identification of the tasks (which are usually referred to as the competencies to be obtained) upon which the instructional program will be based.

WHY DACUM

The main reason for using DACUM has been the desire of many vocational educators to establish a relevant, up-to-date, and localized curriculum base for instructional programs. Clearly, a curriculum base that is soundly determined with maximum input from the businesses and industries that are going to employ the students prepared by vocational and technical education institutions is needed. To permit any secondary school, postsecondary college, or other educational agency to identify a localized research base for curriculum development, an alternative to the traditional, time-consuming, and often costly approach of occupational (job) analysis is needed. DACUM is such an alternative.

DACUM is an occupational analysis procedure that has experienced remarkable success in a relatively short period of time in both Canada and the United States. Because its structure and procedures allow occupational duty and task statements to be identified (1) effectively, (2) quickly, and (3) at a very low cost, DACUM has become closely associated with the movement toward competency-based education (CBE). In addition, the DACUM process has a number of characteristics and qualities that are greatly needed in CBE if it is to become a practical alternative to traditional vocational education.

First, it is a quick process; one that can be completed in only two to three days once committee members have been identified. Second, DACUM is certainly inexpensive when compared to the cost of traditional occupational analyses ($1,000-$2,000 will cover the cost of most DACUM workshops). Finally, the end product of a DACUM analysis, a complete competency profile of an occupation, can be favorably compared in validity with any other method. Given its present popularity and effectiveness, DACUM may soon become the dominant approach to occupational analysis for vocational and technical education.

One additional benefit of DACUM is its public relations value to the educational institution or other agency doing the DACUM. Once employers understand the purpose and the process of DACUM, their first reaction is almost one of sheer shock when they realize that this school or college really wants industry to help them identify the competencies needed by workers in their field. So many employers are familiar with the "rubber stamp" role that they are so often asked to perform on ad hoc committees (and sometimes even on occupational advisory committees) that it often takes them a while to understand that this school or college is really serious about wanting industry to help determine what tasks students must be able to perform in order to make program completers valuable future employees.

Once employers understand what is to be done via DACUM and how the results will be used, it is a rare employer who will refuse to cooperate. Instead, many colleges who have used DACUM report such reactions as the following:

- Offers of equipment and supplies
- Offers of resource persons to help teach in emerging technology areas
- Requests for inservice training programs to meet local industry needs
- Increased enrollments in adult upgrading programs
- Increased support of the educational institution in a variety of ways by local business, industry, labor, and management

While the public relations value of DACUM is secondary to its main purpose, its significant, long-term impact is too important to overlook or lightly dismiss.

WHEN SHOULD DACUM BE USED?

Although the DACUM process has been used for several purposes, it is ideally suited for researching (1) the competencies that should be addressed in the development of new educational programs, (2) the competencies that should be delivered by existing educational programs, and (3) the current relevance of existing DACUM charts.

The Development of New Educational Programs

Once the need for a new instructional program has been established, DACUM can be used to quickly identify the tasks that a successful worker must be able to perform on the job. Such use of the DACUM process will ensure that the new program will be relevant if the tasks (competencies) identified in the process are used as the basis for subsequent program planning and instructional development.

Review of Existing Educational Programs

A DACUM committee can be convened to identify the competencies that should be delivered in an existing instructional program, just as it can be convened to identify the competencies for a new program. In this case, once the competencies have been carefully identified by industry experts, the existing educational program and instructional materials are examined to see if they address all the required tasks. Modifications of the educational program are then made, where necessary, to ensure current relevance of the program.

Update of Existing DACUM Charts

The third major use of the DACUM process is to review an existing occupational profile to determine if it still presents an accurate picture of the tasks performed by workers in that occupation. This type of updating may be conducted when the occupational profile is to be used for preparing job descriptions, conducting worker performance evaluations, making training needs assessments, or other noncurricular purposes. Depending on the occupational area the amount of technological change occurring within it, it is usually necessary to conduct a DACUM-update workshop session on the average of once every three years. Even then, an active advisory committee will probably need to make additional changes in between the workshops in order to maintain a curriculum that is responsive to today's business, industry, and public service needs.

DACUM Quality

Although the DACUM process lends itself to a number of regular and special adaptations, two critical factors are always necessary to obtain a valid DACUM chart. The first is to assemble a committee of eight to twelve experts in the area under study, and the second is to use a trained DACUM facilitator. Without both of these, the resulting analysis is questionable, at best.

Because widespread concern about DACUM being conducted in a high-quality manner that ensures valid results, a "DACUM on DACUM" was conducted at the National Center for Research in Vocational Education in October, 1982 to identify the tasks required of the DACUM coordinator and facilitator. The resulting DACUM coordinator's and facilitator's profile was the research base for developing this DACUM Coordinator's and Facilitator's Handbook.*

A number of DACUM conventions or standards have also been established by experienced facilitators as "rules of thumb" that should always be adhered to if the process used is to be labelled a DACUM occupational analysis. The conventions are as follows:

- The coordinator/facilitator is qualified through training and practical experience
- Committee members are expert workers and immediate supervisors of such workers in about a 5:1 ratio

- Committee members participate throughout the entire workshop
- Task statements abide by all of the criteria for acceptable task statements
- The same task statement appears only once
- There are 8 to 12 duty areas for most occupations
- There are six or more task statements in each duty area

THE DACUM COORDINATOR/FACILITATOR

In this handbook, the term DACUM coordinator is used to refer to the person who plans the occupational analysis process, makes the necessary pre-workshop arrangements--including the selection of the committee of occupational experts--and provides for verification of the tasks. He or she may or may not facilitate the actual development of the DACUM chart, however, as somewhat different skills are required for that process.

The person who actually leads the DACUM occupational analysis workshop is referred to as the DACUM facilitator. Although the same person, if qualified, can function as both the coordinator and facilitator, these function are usually handled by different persons. Whereas many persons can perform quite satisfactorily in the coordinator's role (i.e., carry out the pre-workshop planning and arrangements and the post-workshop activities), the facilitator's job requires some special personal qualities and characteristics.

According to the "DACUM on DACUM" committee, the facilitator should exhibit the following personal traits:

- A professional image and outlook
- A sensitivity for others
- The ability to establish and maintain enthusiasm
- A sense of humor
- The ability to show empathy
- The ability to display and maintain a positive image
- Patience
- The ability to make decisions

In addition, the practical experience of the author in conducting DACUM workshops indicates that the facilitator must also possess the following characteristics:

- Skill in occupational (job) analysis procedures
- The ability to display warmth and establish rapport quickly with participants
- The ability to recognize and clarify the nuances contained in participants statements through appropriate questioning
- A high degree of sensitivity to both verbal and nonverbal communication
- The ability to motivate and encourage participants
- A willingness to assume and "act out" the role of process expert while according participants the role of content experts
- An appreciation of the value of small-group process so that participants are allowed to work things through by themselves
- Excellent listening skills and memory, since the facilitator must be able to "store" many of the participants contributions in his or her memory and be able to retrieve them as needed
- The ability to obtain consensus from the participants

The facilitator also needs to understand the DACUM process itself, because it is not a vague and unstructured affair. Although there are some alternatives and flexibility to parts of the process, it also has some definite parameters and utilizes a specific sequence.

As should now be apparent, facilitating a successful DACUM requires a multitude of skills, many of which cannot be quickly acquired. The qualities described are extremely important to successful performance as a facilitator. The process calls for more than a competent "discussion leader" or "curriculum developer".

The facilitator must establish and maintain the group's pace, balance the group's participation, clarify vague statements by probing for more details, and insist on selection of the most appropriate action verbs and task statement modifiers and nouns. The facilitator must motivate and lead the group and control the process, yet never impose content judgments or decisions on the participants.

Persons who are considering becoming a DACUM facilitator should carefully assess their personal traits and characteristics before deciding to enroll in a DACUM facilitator training program. And those responsible for helping select facilitator trainees need to keep these qualities in mind so as to enable all participants to make the best investment of their time and energy.

An excellent source for task listings and other information concerning competency-based education is Open Entries. This newsletter serves as a competency-based education information exchange and is produced by the Center for Instructional Development and Services, Florida State University, Stone Building, Tallahassee, Florida 32306-3018. The following resource is a copy of Open Entries and is included to give readers some idea of the scope of this newsletter.

OPEN ENTRIES

A COMPETENCY-BASED EDUCATION INFORMATION EXCHANGE

ELIMINATE THE GUESSWORK WITH PERFORMANCE-BASED INTERVIEWING

THE RIGHT EMPLOYEES can make all the difference to a small business. That's why five postsecondary institutions across the country are taking part in the **Selection Services Project**, in which assistance is offered to area employers to help them improve hiring practices. This pilot community outreach project teaches employment interviewers a systematic approach that documents candidates skills and abilities.

The job interview commonly is the basis for hiring decisions. However, research indicates that traditional interviews frequently fail to actually determine which person is best qualified and suited for a job.

Performance-Based Interviewing (PBI), a system developed by Assessment Designs, International (ADI), a division of Wilson Learning Corporation, was adapted specially for this project. With PBI, candidates receive a realistic job preview and the opportunity to demonstrate job-specific skills and abilities. The purpose of the performance-based interview is to improve productivity through more effective selection and placement decisions.

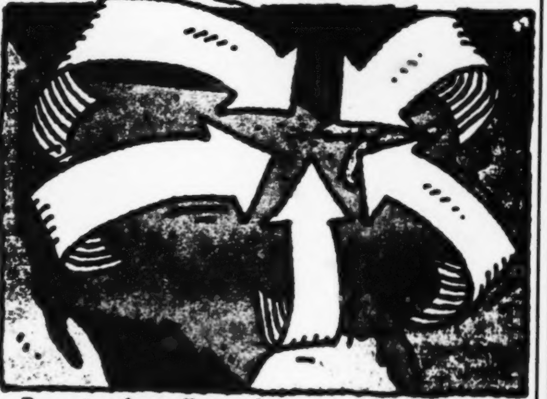
PBI is based on three premises: 1. To be effective, a selection method must be based on job-relevant, observable, measurable information. Therefore, PBI teaches interviewers to make hiring decisions based on observations of candidates' skills and abilities in typical situations related to the actual job. 2. Interviewers must be carefully trained. Therefore, PBI teaches interviewers skills such as observing, documenting, questioning, listening, responding, and evaluating job-related data. 3. Candidates should and do select organizations as well as vice versa. Therefore, PBI allows for candidates to obtain a realistic preview of a job to see whether the job activities and performance requirements meet *their* expectations. A typical performance-based interview lasts about one hour and includes two or three "mini-simulations" of job skills.

The Selection Services Project is being field-tested at: Bunker Hill Community College, Boston, Massachusetts; College of San Mateo, San Mateo, California; Technology Exchange Center, Garden Grove, California; Daytona Beach Community College, Daytona Beach, Florida; and Fox Valley Technical Institute, Appleton, Wisconsin (last year's Mid-America Conference host). If the project is successful, it will be extended so that other schools can provide ADI's Performance-Based Interviewing as a new service to their local business communities.

You can find out more about the Selection Services Project and PBI at the upcoming Mid-America Conference in St. Paul, Minnesota, or by writing or calling *Linda A. Pfister, OE, Selection Services Project, 2107 Majestic Oak Circle, St. Cloud, FL 32769; (305) 892-2603.*

YOUR TICKET TO EXCELLENCE: MID-AMERICA CONFERENCE 1987

ACHIEVING INSTRUCTIONAL EXCELLENCE is the theme of the Midwest Association for Individualized Instruction's eighth annual **Mid-America Conference on Competency-Based Education**, to be held June 1–3 in St. Paul, Minnesota. This means three days filled with opportunities to exchange ideas with other educators and to learn about innovative programs and processes. Whether you are an instructor or administrator in vocational, technical, or adult education, an industry trainer, a counselor, a curriculum planner, or are involved in any other vocational specialty, you'll benefit from the wide variety of concurrent sessions.



Presenters from all over the nation will focus on refining instructional skills; teacher effectiveness models; developing quality CBE curricula; staff development for CBE; using new instructional technologies; cultivating and operating partnership activities with business and industry; and implementing and managing successful CBE programs. Participants can get a firsthand view of individualized instruction at one of the nation's oldest and best-known CBE institutions: Northeast Metro—formerly 916—Technical Institute, this year's host.

Distinguished speakers include Larry Wilson, founder of Wilson Learning Corporation, who will deliver the keynote address; innovative educator and author Madeline Hunter; industry/education communications consultant Allan Zimmerman; and human-resource development/management-training specialist Jack Spring.

For more information on the program, registration, or becoming a presenter, write or call *Judy Stengel, OE, Northeast Metro Technical Institute, 3300 Century Ave. N., White Bear Lake, MN 55110; (612) 770-2351.*

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MATERIALS OFFERED

Specific Program Areas

We recently developed a DACUM chart on **Pipefitting**, which includes layout, fabrication, assembly and installation, testing piping systems, and maintaining piping systems. If you would like a copy, write or call *Jerold Shepard, OE, Dean of Vocational Instruction, Mississippi Gulf Coast Junior College, Jackson County Campus, P.O. Box 100, Gautier, MS 39553; (601) 497-9602.*

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A new computer-aided instructional package from the Mid-America Vocational Curriculum Consortium (MAVCC) shows students how a computer is used as a viable business tool. **Microcomputer Business Applications** focuses on applications of a variety of business, marketing, and office software. Job sheets, with accompanying data disks, coincide with Appleworks (for Apple IIc or IIe), DeskMate (for TRS-80 Model 4, Tandy 1200, or IBM-PC). The job sheets allow students to apply skills learned in each unit. The materials are competency-based, with color-coded objective, information, job, assignment, and test sheets. The eight units of instruction are as follows:

Systems and Software
Electronic Filing
Personnel Records Management
Accounting
Inventory Control
Financial Records Management
Communications
Planning

Manuals for students and teachers are included in the package. In addition to the instructional materials and data disks, there are 31 transparencies and a glossary of business terms and occupations. For more information about **Microcomputer Business Applications**, or to order, write or call *Jim Steward, OE, Mid-America Vocational Curriculum Consortium, 1500 W. 7th Ave., Stillwater, OK 74074-4364; toll free (800) 654-3988, or (405) 377-2000.*

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The Illinois CBVE (ICBVE) Project recently developed and verified 126 **task lists** for the Illinois State Board of Education, Department of Adult, Vocational, and Technical Education. Project members currently are developing and verifying 20 additional task lists and analyzing 1,000 tasks. ICBVE's task analysis involves analyzing each verified task to identify the steps, decisions, cues, errors, technical and related knowledge, attitudes, safety factors, tools, equipment and materials, performance standards, and source of analysis to perform a task. All task lists and task analyses completed in Illinois are being made available through the six regional Curriculum Coordination Centers, through each state's liaison representative (SLR), and through the Curriculum Publications Clearinghouse at Western Illinois University (address below). For more information on the task analyses, write or call *Urban Oen, OE, ICBVE Director, 301 S. Swift Road, Addison, IL 60101; (312) 620-8770.*

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New from the Curriculum Publications Clearinghouse are **Economic Literacy: An Instructional Guide for Vocational Education** and a companion **Annotated Bibliography on Economic Literacy for Vocational Education.** The Guide contains eleven modules dedicated to helping vocational students acquire economic literacy skills needed for success in the work force. Instructors may use the Guide to infuse economic literacy knowledge, skills, and behaviors into existing vocational education programs and related subject areas. Each module includes an overview, objectives, information and activities, and supplemental references. Module topics include worker productivity, the free enterprise system, components of the economy, consumer as decision maker, small business functions, economic principles in the marketplace, economic concerns of the future, and more. The Bibliography is designed to assist instructors in locating pertinent curriculum materials on concepts relating to the components of the Guide. Bibliography and Guide are $7.50 apiece. For more information, or to order, write or call *Diana Burnell, OE, Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455; (309) 298-1917, or (800) 322-3905 toll free in Illinois.*

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Boston Public Schools (BPS) have been actively integrating basic skills into vocational programming. The **Sample Sequence and Pacing Vocational Supplement for Basic Math II/Carpentry** was developed specifically for carpentry students in need of further activities to enrich their math curriculum. The proposed problems and activities are directly related to carpentry, enabling students to achieve competence with specific math objectives by associating them with real-life, real-work situations. To request a copy of this sample document or to find out more about BPS basic skills support activities, write or call *Joyce Malyn-Smith, OE, Manager, Occupational Instructional Design, Boston Public Schools, 75 New Dudley St., Boston, MA 02119; (617) 442-5200.*

CBE - General

Many competency-based adult education (CBAE) resources are available at no charge from the U.S. Department of Education, Division of Adult Education. **CBAE: Challenge for Change** explores several aspects of the educational change progress and discusses how CBE can be used to deliver more—and better—services to youths and adults. **Basic Skills for Job Training: CBAE in Action—What Math, Reading, and Writing Skills Do Students Need to Succeed in Vocational Training?** details a step-by-step process for identifying the basic skills needed by persons entering vocational training. To obtain a free copy of one of these documents or to find out about other resources, write or call *Joyce Fowlkes Campbell, OE, U.S. Department of Education, Division of Adult Education, 400 Maryland Ave. S.W., Room 522, Reporters Building, Washington, DC 20202-5515; (202) 732-2399.*

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New from the National Center for Research in Vocational Education (NCRVE) is a multimedia package designed to enable academic and vocational teachers to create customized materials that combine vocational and employability competencies with basic academic skills. **BASICS: Bridging Vocational and Academic Skills** contains 23 documents, black-line masters, PBTE modules, guides from the Competency-Based Administrator Education series, an orientation videocassette, and four posters. Five Performance-Based Teacher Education (PBTE) Modules, from the well-known American Association for Vocational Instructional Materials (AAVIM) series, are included in the package to teach teachers how to integrate theory and application. **A Bridger's Guide** provides teachers with practical and theoretical information on developing or selecting appropriate applied-basic-skills instructional materials. **Targeted Teaching Techniques** provides vocational and academic teachers with assessment, planning, and management tools for a comprehensive and effective approach to improve students' basic skills. **Developing an Instructional Program** and the **Orientation** to **BASICS** videocassette include implementation guidelines, descriptions of support roles, success stories, examples of a variety of approaches, and posters and brochures that highlight strengthening basic skills. The entire **BASICS** system is available from NCRVE at a cost of $198.00. For more information about **BASICS: Bridging Vocational and Academic Skills** or to order, contact *Judy Cohen, OE, Program Information Office, NCRVE, The Ohio State University, 1960 Kenny Rd., Columbus, OH 43210; 1-800-848-4815, or (614) 486-3655 in Ohio.*

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To help guidance counselors stay on top of new developments in the field, Bell & Howell and the National Center for Research in Vocational Education teamed up to produce **The Competency-Based Career Guidance Series**. Thirty-four self-contained learning modules are designed to develop skills in five areas of career guidance: planning, supporting, implementing, operating, and evaluating programs. The competency-based materials are intended for both preservice and inservice training of professional and paraprofessional career guidance personnel in educational institutions, service agencies, industry and business, employment services, JTPA agencies, and other agencies that are responsible for the employment and professional development of guidance personnel. The self-contained modules can be used with individuals or groups and can be modified and enriched by incorporating materials of local interest. Modules may be purchased individually or in sets. For more information or to order, write or call *Deb Phillips, OE, Bell & Howell Publication Products, Old Mansfield Rd., Wooster, OH 44691-9050; toll free (800) 321-9881 or in Ohio (216) 264-6668.*

MATERIALS WANTED

CBE Methodology

We are in the process of developing our competency-based vocational programs and are looking for information on **inexpensive PC-DOS/MS-DOS software** for the following purposes:

- to "author" computer-based instruction
- to develop and analyze survey instruments for needs assessments

We also would like information on the use of data base filing of CBVE objectives and competency standards, especially using PC-DOS/MS-DOS. If you can help, please contact *Ed Henderson, OE, Coordinator, Articulation Program, Greenville Schools/Greenville Tech, Box 2848, Greenville, SC 29602-2848; (803) 299-0706.*

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We are in the process of developing an implementation manual for CBE in postsecondary technical vocational training programs for the Texas Coordinating Board of Colleges and Universities. We would like CBE users to send us copies of documents such as learning guides, student orientation materials, task listings, student progress sheets, financial aid guidelines, attendance/progress policies, or any other resources associated with the delivery of CBE. Please respond or send materials to *John Loughlin, OE, Program Chair, Instructional Development Services, Texas State Technical Institute-Amarillo, P.O. Box 11197, Amarillo, TX 79111; (806) 335-2316.*

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The Illinois CBVE (ICBVE) Project would like to receive completed task (instructional) analyses for any occupational area and audiovisual materials on preparing task analyses. (They will be used in conjunction with the task list project described on page 2, this issue.) Project members are interested in sharing materials with other developers to avoid duplication of effort, wherever possible. If you have a task analysis or other materials to share, write or call *Urban Oen, OE, ICBVE Project Director, 301 S. Swift Rd., Addison, IL 60101; (312) 620-8770.*

Specific Program Areas

We are interested in obtaining task lists or other curriculum/instructional materials for **Gunsmith and Locksmith** training programs. If you have materials to share, please write or call *Bill Muscatello, OE, Curriculum Resource Teacher, VAADS and CSVE Management Systems, Orange County Public Schools, P.O. Box 271, 434 North Tampa Ave., Orlando, FL 32802; (305) 422-3200, ext. 538.*

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We are initiating CBE in our secretarial program and would like to receive task lists, learning modules, and other CBE materials on **Secretarial Science**. If you have materials to share, write or call *(Ms.) Hayne White, Chesterfield/Marlboro Technical College, Chesterfield Hwy., P.O. Drawer 1007, Cheraw, SC 29520; (803) 537-5286.*

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We are looking for good competency-based instructional materials for statewide teacher committees to review for possible adoption. The following vocational programs currently are being targeted:

Automotive Body Repair and Refinishing
Medical Assisting
Basic Business Management
Practical Industrial Arts Skills
Ornamental Horticulture
Entrepreneurship
Diversified Cooperative Training
Child Guidance, Care, and Management Services
Computer Software for Basic Skills Remediation

If you have materials to share, write or call *Marv Patterson, OE, VIMAS Coordinator, Center for Instructional Development and Services, Florida State University, 2003 Apalachee Pkwy., Tallahassee, FL 32301-4829; (904) 487-2054.*

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We are developing instructional materials for mainstreamed special-needs students. We plan to include related reading and math skills activities and would like to hear from others who know of learning resources or have developed successful techniques for **teaching reading and math skills in the areas of auto mechanics and/or welding**. If you have materials or methodology to share, please write or call *Christy Khojasteh, OE, Special Needs Editor, Instructional Materials Lab, University of Missouri-Columbia, 10 Industrial Education Bldg., Columbia, MO 65211; (314) 882-2883.*

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We are looking for learning modules in **Manufacturing/Numerical Control or Computerized Numerical Control**. Please call or write *Tad Foster, OE, Industrial Education Specialist, Vocational Education Service, University of Illinois, 1401 S. Maryland Dr., Urbana, IL 61801; (217) 333-3872.*

CBE - General

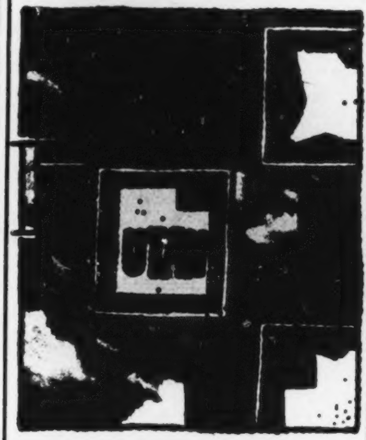
I am developing a study on the comparative analysis of occupational analysis techniques commonly used in vocational education. Please send any research you have, or contacts that may be helpful in locating such research, to *Rebecca Douglass, OE, East Central Network, Sangamon State University, F-30, Springfield, IL 62708; (217) 786-6375.*

Don't miss the "Materials Wanted" section. You may be able to make someone's day!

[redacted]

NEW DEVELOPMENTS: A NEW MEMBER

UTAH'S OFFICE OF VOCATIONAL EDUCATION spent two years reviewing selected national and regional curriculum-development organizations. After surveying the field, Utah found that the "V-TECS package" best suited the state's needs. Criteria such as quality, scope, and "up-to-dateness" of developed products were considered. V-TECS, with products in three related areas—occupational and task analysis materials, criterion-referenced test items, and curriculum guides—was clearly outstanding in all areas reviewed. Based on the quality of its materials and related services, V-TECS was identified as the best source of products required to implement Utah's vocational education programs and goals.



The major thrust of vocational-technical education in Utah is the statewide implementation of outcome-based vocational education (OBVE) programs. One of the primary components of the OBVE system is performance- or criterion-referenced testing. Impeding implementation, however, have been the expense and length of time required for development and validation of test items for all occupational-preparation programs.

The V-TECS's Criterion-Referenced Test-Item Bank is expected to be a powerful tool in Utah's projected testing activity. Access to the test-item bank will give Utah the means to carry out a 1986 state ruling to reimburse districts for each student that exceeds set placement and competency standards. In fact, the state's initial contribution to the Consortium will be to act as a field-test site for test items developed by other member states.

Also of interest to Utah were the capabilities of the Occupational Data Analysis System (ODAS). With its several cross-referenced, readily accessible, on-line computer data bases, Utah educators will be using ODAS in curriculum development, for career counseling, and to enhance economic development efforts across the state (see story on page 5).

In becoming a full member of the Consortium, Utah joins the state vocational agencies of Alabama, Arizona, Arkansas, Florida, Georgia, Illinois, Indiana, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New York, North Carolina, Oregon, Pennsylvania, South Carolina, Virginia, West Virginia, and other new states Washington and Oklahoma. Each full-member state develops a small number of V-TECS products each year to share with the group. For an annual investment of $40,000-$100,000, depending on state size and resources, each member state gains curriculum materials and services worth almost $2 million per year in development costs. The entire spectrum of past and present V-TECS products becomes available immediately to new members of the Consortium.

For more information about V-TECS activities or OBVE in Utah, write or call *Charles Losh, OE, V-TECS Technical Coordinator, Utah State Office of Vocational Education, 250 East 500 S., Salt Lake City, UT 84111; (801) 533-5574.*

V-TECS has several categories of participation, including full membership for states with fewer students and smaller budgets. For more information about joining the Consortium or on Consortium products, services, or activities, write or call *Ron McCage, OE, Director, V-TECS, COEI, Southern Association of Colleges and Schools, 795 Peachtree St. N.E., Atlanta, GA 30365; (404) 897-6157.*

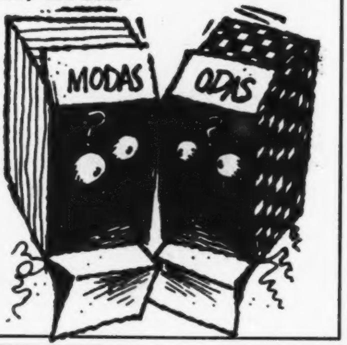
What are MODAS and ODAS?

EACH YEAR, MEMBERS OF V-TECS, with the exception of Michigan, produce new Catalogs, Guides, or criterion-referenced test items for the membership to share. As its product contribution, Michigan provides V-TECS members access, on a cost-recovery basis, to the Michigan Occupational Data Analysis System, known as MODAS. With the dropping of the first name—"Michigan," the system is known to V-TECS users as ODAS.

MODAS/ODAS is supported by a grant to Michigan State University from the Michigan Department of Education. The system offers users flexibility in local curriculum design. Using keywords, or occupational descriptors, new, customized task lists can be developed from the many existing V-TECS task lists on-line.

The system encourages users to base curriculum on actual job skills selected from a number of sources. For example, tasks to be included in a unit on hydraulics and pneumatics can be selected from 20 existing task lists that contain related skills. The system can be used in conjunction with Michigan's occupational test-item bank and, soon, with V-TECS's test-item bank, to coordinate customized assessment with customized curriculum.

ODAS is one of several services available to V-TECS members. For more information about logging on, write or call *Carol Culpepper, OE, MODAS Director* or *Chris M. Olson, OE, Director*, both at *Michigan Occupational Student Assessment Center, 102 Wills House, Michigan State University, East Lansing, MI 48824; (517) 355-1887.*



IN PROGRESS: PROGRESSIVE WORK

ODAS IS ON-LINE IN INDIANA

BECOMING COMPUTER LITERATE and well acquainted with the Occupational Data Analysis System (ODAS) were the goals of participants in the Occudata Institute, a three-and-one-half day workshop cosponsored by Indiana University's Vocational Education Services (VES), the Indiana State Board of Vocational and Technical Education (VTE), and the Indiana Consortium for Computer and High Technology Education.

The Institute, held this past summer at Indiana University, provided intensive training in the applications and use of ODAS to 35 Indiana vocational educators. Participants included secondary-level curriculum and program developers, including teachers, department chairpersons, area school administrators, and State Board of VTE staff. Some participants who had never before worked with a computer found themselves, by the third day, using a sophisticated data base. Training was delivered in both elementary and advanced concepts to suit both beginning and advanced computer users.

The ODAS data base is particularly helpful in obtaining occupational descriptions for use in developing performance-based curriculum and detailing job-seekers' work experience. The data base is accessible on-line through a computer terminal and modem.

Stops on a "guided tour" of ODAS included extracting task lists, keywording with the *Handbook of Occupational Keywords*, designing keyword searches, selecting search strategies, and applying the system to client assessment in employment programs. By the end of the tour, participants were conversant in the ODAS language and were able to use the system effectively. Many actually obtained materials, including task lists, they needed to develop programs for the coming year.

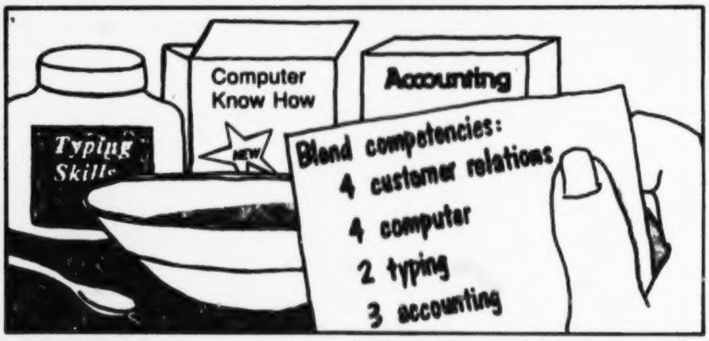
As a follow-up to the Occudata Institute, VES is providing continued support, consultation, and technical assistance to enable Institute graduates to connect computers in their schools with ODAS. These connections are being made possible by a grant from the Indiana Consortium for and support from the Indiana State Board of VTE.

For more information on the Occudata Institute, contact *Scott Gillie, OE, Consultation and Field Services Specialist* or *Dr. James Pershing, Director*, both at *Vocational Education Services, Indiana University, 840 State Road 46 Bypass, Bloomington, IN 47405; (812) 335-6711.*

USING V-TECS MATERIALS IN ECONOMIC DEVELOPMENT

CONSORTIUM MEMBERS, during the many years V-TECS has been in the "occupational- and task-analysis business," have developed a significant amount of material that can and is being used for economic development. Available V-TECS materials can be grouped into four general categories: Catalogs, Guides, criterion-referenced test items, and ODAS—the Occupational Data Analysis System.

Originally, the V-TECS Catalog was conceived as a document that would contain an occupational analysis (task list), standards and conditions of competent performance (the performance objective), and a task analysis (the performance guide). The user could choose those tasks and related information to include in his or her course, much as one would choose tools or other items from a catalog. It is this concept of *choosing tasks* to be covered in a training program that lends itself best to the task of economic development.



When the term "economic development" is used in conjunction with vocational-technical education, it usually means developing training materials and programs for industries that wish to enter the state or for existing businesses/industries that are changing or expanding their product line.

In fact, the new jobs for which people are to be trained often are composites of or contain components/tasks of traditional occupations. In most cases short-term, intensive training is desired. However, this type of specialized, industry-specific training generally is not offered in traditional secondary or postsecondary programs.

Since V-TECS materials are based on stringent occupational analysis procedures that include task validation by incumbent workers, these materials can provide a direct link to jobs—both existing and "new and emerging" occupations. Following are some suggestions for using V-TECS materials "creatively" in economic development activities.

ODAS is a powerful tool for economic development. The ODAS data bank has all V-TECS Catalog task lists on-line, which are referenced by "keywords." The economic developer can use ODAS to identify a "shopping list" of tasks for representatives from the new or expanding business/industry to review. Having identified the needed tasks, the appropriate portions of the Catalogs and Guides, containing the tasks, performance objectives, and performance guides, can be used to develop specific training materials for the new workers.

The task list is a powerful tool in economic development activities, since it provides the *basic* document for dialogue with industry to identify needs. ODAS has the flexibility needed to identify all required tasks quickly from many related task lists and to indicate where those tasks may be found in already developed materials.

Once the specific tasks are consolidated into a meaningful task list agreed to by the developer and the industry representative and related V-TECS resource materials are identified, then the training program development activity will be relatively straightforward. Some tasks will be new tasks for which no resource materials are available. The developer and industry representative can work together to verify these tasks and to analyze each for component parts, i.e., standards, conditions, and performance guide.

Speed is usually of the essence in the process of training development, since production is directly linked to dollars. Relationships made through economic development can be ongoing as educators continue to work with local business and industry to identify future needs.

For further information on using V-TECS materials in economic development, contact the author *Charles Losh, OE, Assistant Director, Vocational Education, Utah Board of Education, 250 East 500 S., Salt Lake City, UT 84111; (801) 533-5574.*

CANADA COORDINATES COMPETENCY CURRICULA

THE CONCEPT OF CURRICULUM COORDINATION has, in recent years, been given a boost by the emergence of competency-based education (CBE). More and more, the cooperative spirit engendered by the adaptability of CBE training methods and materials is being encouraged in Canada.

Following a recommendation of the Canadian Council of Ministers of Education to establish an information data base, Holland College, on Prince Edward Island, launched the Canadian Curriculum Exchange applied research project last September. This two-year project has been endorsed by the Association of Canadian Community Colleges and funded by the Canada Employment and Immigration Commission. A proposed Curriculum Exchange Centre is meant to facilitate the sharing of materials and information among institutions.

Recognizing the time lag between the emergence of the labor market's demand for workers trained in new or changed occupations and the supply of skilled workers for these jobs, government and education officials reasoned that part of the lag is the time required by training institutions to develop programs to train in-demand workers. They concluded that training-development time could be reduced through efficient access to existing curriculum materials. Getting needed training information into users' hands as quickly as possible will be the goal of the center.

The project has two distinct stages. The first involves the collection of information on CBE modular-type training programs in Canada. The second will see the creation and operation of a demonstration Curriculum Exchange Centre.

Information collected during the first stage will include the number and types of CBE programs, their locations, descriptions of the programs, enrollment data, and a contact person for each program. This "network" of contacts will make it possible for educators with curriculum-development needs to access current, detailed information.

The Curriculum Exchange Centre, to be established and made operational during stage two, will be located at Holland College, a pioneering center of modular training. The center will serve as an information broker, retrieving information for clients through its network of contacts or referring clients directly to appropriate contacts.

The center also will establish and maintain liaisons with other curriculum centers and networks outside of Canada. Likewise, computer data bases will be used to search for curriculum materials.

For more information about the project, contact *Maureen Steele, OE, Project Officer, Curriculum Exchange Centre Project, Holland College, Charlottetown Centre, Weymouth Street, Charlottetown, P.E.I., C1A 4Z1, Canada; (902) 566-9601.*

STUDENTS AND TEACHERS FIND INCENTIVES IN ARTICULATION

FIVE YEARS AGO, four secondary career/vocational centers and fourteen high schools in The School District of Greenville County, South Carolina, joined with Greenville Technical College to promote a vocational education continuum called the **Articulation Program.** The program is integrated fully into the activities of the Greenville Schools and Greenville Tech. Jointly sponsored and funded by both parties, the project has grown more successful each year.

Articulated, **performance-based curriculum guides** promote occupational curriculum coordination. Through the process of articulation, secondary vocational education objectives and competency standards have been updated, improved, and standardized. While lateral articulation has been instituted among secondary vocational programs, vertical articulation with similar postsecondary-level programs at Greenville Tech has been facilitated.

One of the most important features of the curriculum guides is **the outcome-referenced competency tests.** Prior to implementing articulation, secondary and postsecondary instructors were trained in developing and selecting valid test items. Outcome-referenced test banks were developed jointly by the instructors, who incorporated industry input. Instructional objectives and test items for each curriculum guide were reviewed by industry representatives during a two-year field-trial period.

The first "competency/exemption" test, the **Articulated Vocational Skills Competency Test,** was administered last May to graduates of the secondary Trade and Industries program. Several students received advanced placement in postsecondary programs at Greenville Tech based on their test results. Immediate plans are to expand testing to secondary Business, Technology, and Health Occupations programs.

This initial test activity proved successful—and instructional. Secondary and postsecondary instructors worked well together on an activity of common interest. The tests did—and will continue to—serve as a motivational factor for both students and faculty. Also, the test results provided a reference for evaluating the current levels of learning and instruction. On the basis of these findings, a number of curriculum improvements have been made.

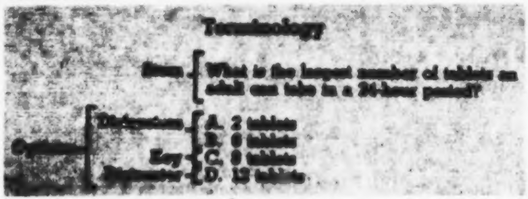
YOU HAVE COMPLETED ALL COURSE 103 OBJECTIVES...
GO DIRECTLY TO COURSE 204!

Co-oping plays a strong role in the Greenville articulation activities. Cooperative Education programs at all participating institutions blend learning in a school setting with structured on-the-job training. A task force made up of secondary and postsecondary cooperative education specialists has developed articulation guidelines for this important educational component.

To find out more about Greenville's Articulation Program, or to receive a schematic of the articulated vocational education delivery system, write or call *Ed Henderson, OE, Coordinator, Articulation Program, Greenville Schools and Greenville Technical College, Box 2848, Greenville, SC 29602-2848; (803) 299-0706.*

DESIGN TIPS

WRITING TEST ITEMS is one of the most demanding tasks faced by an instructor. "Selection" items are probably the most common test items. These include *multiple-choice, matching, and true-false*. The following guidelines for writing and reviewing test questions were presented at a test development and writing workshop for competency-based adult education.



Writing Multiple-Choice Items

1. Write a stem that presents a single, well-defined question. If possible, make the stem a complete sentence with a question mark at the end. If an incomplete statement format is used, make the stem as near a complete statement as possible.
2. Keep response options brief and similar to each other in form.
3. All of the options should be plausible.
4. Avoid using negatives such as *no, not,* and *except*. If you must use a negative word, underline it and/or write it in capital letters so the test-taker won't miss it.
5. Numerical options should be in numerical order, either increasing or decreasing consistently. Verbal answers should be in alphabetical order.
6. Reading level and language should be as simple and direct as possible.
7. Avoid giving unintentional clues to the correct answer (for example, by using singular or plural words, or *a* or *an* in such a way that shows certain responses to be correct or incorrect).
8. Avoid using *none of the above* and *all of the above* in the response options.
9. Check that the item tests the objective for which it is written.
10. Be certain that the content is accurate and up-to-date.

Writing Matching Items

1. Each of the lists should be homogeneous; that is, each list should include words or phrases that are similar in form or type to each other. It may be easier to do this if you give each list a heading, such as *terms* and *definitions* or *tools* and *uses*.
2. Keep the lists relatively short—ten or less.
3. The two lists should *not* be of the same length.
4. Directions should state clearly how the matching should be done. If items in a list may be used more than once, say so in the directions.

1. Write items that are unquestionably true or false. For example, "Alcoholism is a disease" is not clearly one or the other. However, you may say, "According to your textbook, alcoholism is a disease. T____ F____" if that is indeed the case, and you wish to test their knowledge of what the textbook said.
2. Avoid negative statements, especially double negatives.
3. If you have a series of true-false questions, do not make the true statements consistently longer—or shorter—than the false statements.
4. Avoid trivial questions, such as "A nurse's uniform should be clean. T____ F____".

Checklist for Reviewing Multiple-Choice Items

- ✓ Are there four response options, arranged in a logical order, if one exists (e.g., numerical, alphabetical)?
- ✓ Is there one, and only one, correct answer that would be agreed to by subject matter experts?
- ✓ Are the wrong options plausible and appropriate?
- ✓ Is the question clear and unambiguous?
- ✓ Is the item stated positively (avoids using *not, except,* etc.)? If it must be stated negatively, is the negative word underlined or capitalized?
- ✓ Is the item free of unintentional clues to the correct answer? (no grammatical, length, or "klang" association clues)?
- ✓ Does the item measure the intended competency at the appropriate level? Does the item deal with an important aspect of content, not with trivia?
- ✓ Is as much of the item as possible in the stem, with options kept as short as possible?
- ✓ Does the item avoid the options "none of the above" and "all of the above"?
- ✓ Does the item avoid using words such as *always, only,* or *never* that might give away an answer?
- ✓ Is the content of the item accurate and up-to-date?

CODE IT OE.

You may notice in this issue that the contact person listed at the end of each item has an additional title following his or her name—OE. It stands for *OPEN ENTRIES* and is a cue for the contact person and us that will help track the number of responses to items appearing in your exchange periodical. Please use the code in addressing written communication to a contact person, and if you talk to a contributor on the phone, be sure to tell him or her you saw it in *OPEN ENTRIES*!

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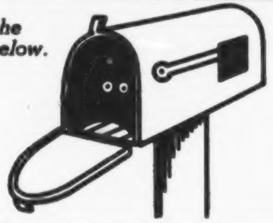
Write to the editor at the return address given below.



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The Center for Instructional Development and Services
Florida State University
Stone Building
Tallahassee, FL 32306-3019

Florida has long been a leader in the delivery of competency-based education. Vocational technical programs in Florida are required to meet program course standards developed by the State Board of Education.

Each program course standards is composed of two parts: a curriculum framework and student performance standards. The curriculum framework includes four major components: major concepts/content, laboratory activities, special notes and intended outcomes. Student performance standards are listed for each intended outcome.

The standards do not prescribe how instruction should be delivered but the Florida Department of Education supports the belief that competency-based education is the most efficient means. Standards are reviewed annually and revised as needed based upon changes in occupations utilizing input from business and industry, employers, licensing and credentializing agencies, professional associations, state technical committee and other representatives from the private sector.

A sample of a program course standards for laser electro-optic technology is included on the next several pages.

For additional information contact:
Florida Department of Education
Division of Vocational, Adult and Community Education
Bureau of Vocational Program and Staff Development
Program and Staff Development Section
Tallahassee, Florida

CURRICULUM FRAMEWORK **PROGRAM AREA:** Industrial
FLORIDA DEPARTMENT OF EDUCATION **EFFECTIVE DATE:** July, 1986
PROGRAM TITLE: Laser Electro-Optic Technology
CODE NUMBER: Secondary ____________ Postsecondary EST0230
Florida CIP IN15.030400
Secondary School Credits __________ College Credits __________ Postsecondary Adult Vocational Credits _______
APPLICABLE LEVEL (S): _____ 7-9 ____ 9-12 ____ Postsecondary Adult Vocational
Postsecondary Vocational _________ Other 13-15
CERTIFICATION COVERAGE: TEC ELEC @ 7 ELECTRONIC 7

I. MAJOR CONCEPTS/CONTENT: The purpose of this program is to prepare students for employment as electrical and electronic technicians (10080803), laser technicians (019.181-010), or to provide supplemental training for persons previously or currently employed in these occupations.

The program prepares students to assist engineers and scientists in assembly, installation, repair, adjustment, and operation of various types of lasers.

The content includes, but is not limited to, communication skills; leadership skills; human relations and employability skills; safe and efficient work practices; identification, use and maintenance of lasers and laser systems; use of optical elements; performance of laser technology applications; calibration, troubleshooting and analyzing laser peripheral components; and demonstration of laser energy applications.

II. LABORATORY ACTIVITIES: Shop or laboratory activities are an integral part of this program and provide instruction in laser safety, optical cleaning, applicable laser test equipment, optical systems, laser technology, laser peripheral components, applicable laser applications, laser projects, and laser optics measurements.

III. SPECIAL NOTE: The Vocational Industrial Clubs of America, Inc., is an appropriate vocational student organization for providing leadership training experiences and reinforcing specific vocational skills. When provided, these activities are considered an integral part of this instructional program.

Students admitted to the program must not be color blind and should have a math background in algebra and trigonometry.

The cooperative method of instruction may be utilized for this program. Whenever the cooperative method is offered, the following is required for each student: a training plan, signed by the student, teacher and employer which includes instructional objectives and a list of on-the-job and in-school learning experiences; a work station which reflects equipment, skills and tasks relevant to the occupation the student has chosen as a career goal. The student must receive compensation for work performed.

In accordance with Section 233,0695 F.S., the minimum basic skills grade level required for this postsecondary adult vocational program is: Mathematics 10.0, Language 9.0. This grade level number corresponds to a grade equivalent score obtained on a state designated basic skills examination.

The typical length of this program for the average achieving student is 2400 hours.

IV. INTENDED OUTCOMES: After successfully completing this program, the student will be able to:

01. Demonstrate proficiency in DC electronics.
02. Demonstrate proficiency in AC electronics.
03. Demonstrate proficiency in semiconductor devices and circuits.
04. Demonstrate proficiency in electronic circuits.
05. Demonstrate proficient soldering and chassis assembly techniques.
06. Demonstrate communications skills including technical recording and reporting, leadership skills, and human relations skills.
07. Demonstrate proficiency in analysis methodology.
08. Demonstrate proficiency in digital circuits and devices.
09. Demonstrate proficiency in microprocessors.
10. Identify, use and maintain lasers and laser systems.
11. Demonstrate and practice the uses of optical elements.
12. Demonstrate and analyze wave optical systems.
13. Perform laser technology applications.
14. Calibrate, troubleshoot and analyze laser peripheral components.
15. Demonstrate and practice laser optical measurements.
16. Analyze, construct and demonstrate laser optical measurements.
17. Demonstrates employability skills.

STUDENT PERFORMANCE STANDARDS	EFFECTIVE DATE: ____________
PROGRAM AREA: Industrial	SECONDARY NUMBER: ________
PROGRAM TITLE: Laser Electro-Optic Technology	POSTSECONDARY NUMBER: ___

01.0 DEMONSTRATE PROFICIENCY IN DC ELECTRONICS THROUGH PROBLEM SOLVING, USE OF CIRCUIT DIAGRAMS AND SCHEMATICS, IDENTIFICATION AND APPLICATION OF COMPONENTS AND CIRCUITS, USE OF TOOLS AND TEST EQUIPMENT, AND TROUBLESHOOTING PROCEDURES-- The student will be able to:

01.01 Solve electronic math problems related to DC circuits including series, parallel, and series-parallel circuits.
01.02 Identify and define electronic theory and sources of electrical energy.
01.03 Define the relationship between current, voltage, resistance and power.
01.04 Solve basic electronic problems involving current, voltage, resistance and power.
01.05 Identify and measure resistors.
01.06 Use an analog and digital multimeter to measure current, voltage,

resistance, and continuity of passive components.

01.07 Draw, analyze, consruct and troubleshoot series circuits.
01.08 Draw, analyze, construct and troubleshoot parallel circuits.
01.09 Draw, analyze, construct and troubleshoot series-parallel circuits.
01.10 Draw, analyze, construct and troubleshoot voltage divider circuits.
01.11 Demonstrate a knowledge of magnetism and electromagnetism.
01.12 Analyze and calculate RL and RC time constants.
01.13 Set up and operate power supplies for DC circuits.
01.14 Set up and operate oscilloscopes for DC circuits.
01.15 Troubleshoot and locate defective components in a functional DC circuit consisting of resistors, relays, lamps, switches, fuses, inductors, rheostats, potentiomenters,capacitors, conductors, and power supplies

02.0. DEMONSTRATE PROFICIENCY IN AC ELECTRONICS THROUGH PROBLEM SOLVING, USE OF CIRCUIT DIAGRAMS AND SCHEMATICS, IDENTIFICATION AND APPLICATION OF COMPONENTS AND CIRCUITS, USE OF APPROPRIATE TOOLS AND TEST EQUIPMENT, AND TROUBLESHOOTING PROCEDURES--The student will be able to:

02.01 Solve electronics math problems related to AC circuits including: RC, RL, RLC, LC, and Z for series, parallel and series-parallel circuits.
02.02 Identify properties of an AC sineusoidol waveform.
02.03 Use an analog and digital multimeter to measure current, voltage, resistance, and continuity of passive components.
02.04 Draw, analyze, construct, and troubleshoot AC resistive circuits.
02.05 Draw, analyze, construct, and troubleshoot series, parallel, and series-parallel capacitive and resistive-capacitive circuits.
02.06 Draw, analyze, construct, and troubleshoot series, parallel, and series-parallel inductive and resistive-inductive circuits.
02.07 Draw, analyze, construct, and troubleshoot series, parallel, and capacitive-inductive circuits.
02.08 Draw, analyze, construct, and troubleshoot transformer circuits.
02.09 Draw, analyze, construct, and troubleshoot series, parallel, and series-parallel resistive-capacitive-inductive circuits.
02.10 Draw, analyze, construct, and troubleshoot series and parallel resonant circuits.
02.11 Draw, analyze, construct, and troubleshoot low-pass, high-pass, bandpass, and reject active filters.
02.12 Analyze basic motor and generator theory and operation.
02.13 Set up and operate power supplies for AC circuits.
02.14 Set up and operate oscilloscopes for AC circuits.
02.15 Set up and operate frequency counters for AC circuits.
02.16 Set up and operate signal generators for AC circuits.
02.17 Troubleshoot and locate defective components in a functional AC circuit consisting of resistors, capacitors, inductors, and transformers.

03.0 DEMONSTRATE PROFICIENCY IN SEMICONDUCTOR DEVICES THROUGH PROBLEM SOLVING, USE OF CIRCUIT DIAGRAMS AND SCHEMATICS, IDENTIFICATION AND APPLICATION OF COMPONENTS AND CIRCUITS, USE OF TOOLS AND TEST EQUIPMENT--The student will be able to:

03.01 Identify properties of semiconductor material.

03.02 Analyze and measure characteristics of P-N diodes.
03.03 Analyze and measure characteristics of special diodes, including: tunnel rectifier, zener, varactor.
03.04 Analyze and measure characteristics of Bipolar Junction Transistors (BJT).
03.05 Analyze and measure characteristics of Field Effect Transistor (FET)
03.06 Analyze and measure characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET).
03.07 Analyze and measure characteristics of Thyristors.
03.08 Analyze and measure characteristics of Optoelectronic devices.
03.09 Analyze and measure characteristics of Operational Amplifiers (OpAmp).
03.10 Describe Integrated Circuits: importance, construction, and application in digital and linear circuits.
03.11 Set up and operate multimeters for solid state devices.
03.12 Set up and operate oscilloscopes for solid state devices.
03.13 Set up and operate transistor testers for solid state devices.
03.14 Set up and operate transistor testers for solid state devices.

04.0 DEMONSTRATE PROFICIENCY IN ELECTRONIC CIRCUITS THROUGH PROBLEM SOLVING, USE OF CIRCUIT DIAGRAMS AND SCHEMATICS, IDENTIFICATION AND APPLICATION OF COMPONENTS AND CIRCUITS, USE OF TOOLS AND TEST EQUIPMENT, AND TROBLESHOOTING PROCEDURES--The student will be able to:

04.01 Draw, analyze, construct, and troubleshoot diode circuits.
04.02 Draw, analyze, construct, and troubleshoot power supply, regulator, and filter circuits.
04.03 Draw, analyze, construct, and troubleshoot single-stage amplifier.
04.04 Draw, analyze, construct, and troubleshoot multi-stage amplifier.
04.05 Draw, analyze, construct, and troubleshoot oscillator circuits.
04.06 Draw, analyze, construct, and troubleshoot wave-shaping circuits.
04.07 Draw, analyze, construct, and troubleshoot operational amplifier circuits.
04.08 Draw, analyze, construct, and troubleshoot active filter circuits.
04.09 Set up and operate multimeters for analog circuits.
04.10 Set up and operate oscilloscopes for analog circuits.
04.11 Set up and operate frequency counters for analog circuits.
04.12 Set up and operate signal generators for analog circuits.
04.13 Set up and operate transistor testors for analog circuits.

05.0 DEMONSTRATE PROFICIENT SOLDERING AND CHASSIS ASSEMBLY TECHNIQUES--The student will be able to:

05.01 Select, maintain, and use soldering and desoldering tools.
05.02 Use solders with different tin/lead percentages.
05.03 Solder conductors and components to: turret, cup, bifurcated, hooked, pierced terminals and connectors.
05.04 Solder axial lead components to Printed Circuit (PC) boards.
05.05 Remove components and conductors from terminals without damage, including: IC's, TO-5, transistors, diodes, transformers and controls.
05.06 Repair damaged PC board circuitry.

06.0 DEMONSTRATE PROFICIENCY IN ANALYSIS METHODOLOGY--The student will be able to:

06.01 Analyze circuits using: Kirchoff's Current, and Voltage Laws, Superposition, Thevein's and Norton's Theorems, "T", "Pi", and Bridge Networks.
06.02 Analyze circuits using Wheatstone and LCR Bridge.

07.0 DEMONSTRATE PROFICIENCY IN DIGITAL CIRCUITS AND DEVICES THROUGH PROBLEM SOLVING, USE OF CIRCUIT DIAGRAMS AND SCHEMATICS, IDENTIFICATION AND APPLICATION OF COMPONENTS AND CIRCUITS, USE OF TOOLS AND TEST EQUIPMENT AND TROUBLESHOOTING PROCEDURES--The student will be able to:

07.01 Identify number system and solve digital math problems using: binary, octal, and hexadecimal radix; and solve Boolean Algebra problems.
07.02 Identify characterisitics of Integrated Circuits (IC) logic families using: Resistor-Transistor Logic (RLT), Diode-Transistor Logic (DTL), Transistor-Transistor Logic (TTL), Emitter-Coupled Logic (ECL), MOS, and Complementary-MOS.
07.03 Draw, analyze, construct and toubleshoot OR/NOR, AND/NAND, XOR gates.
07.04 Analyze, and minimize logic circuits using: Boolean Algebra and Karnaugh Maps.
07.05 Draw, analyze, construct, and troubleshoot Flip-Flops and Latches circuits using: "R-S", "D", "T", and "J-K" devices.
07.06 Draw, analyze, construct, and troubleshoot clock and timing circuits.
07.07 Draw, analyze, construct, and troubleshoot registers and counters.
07.08 Draw, analyze, construct, and troubleshoot arithmetic circuits.
07.09 Draw, analyze, construct, and troubleshoot combination logic circuits.
07.10 Draw, analyze, construct, and troubleshoot encoders and decoders.
07.11 Draw, analyze, construct, and troubleshoot multiplexers and demultiplexers.
07.12 Draw, analyze, construct, and troubleshoot memory circuits.
07.13 Draw, analyze, construct, and troubleshoot analog-to-digital and digital-to-analog circuits.
07.14 Draw, analyze, construct, and troubleshoot display circuits.
07.15 Set up and operate multimeters for digital circuits.
07.16 Set up and operate logic probes and pulsers for digital circuits.
07.17 Set up and operate oscilloscopes for digital circuits.
07.18 Set up and operate logic/data analyzers for digital circuits.

08.0 DEMONSTRATE PROFICIENCY IN MICROPROCESSORS THROUGH PROBLEM SOLVING, USE OF CIRCUIT DIAGRAMS AND SCHEMATICS, IDENTIFICATION AND APPLICATION OF COMPONENTS AND CIRCUITS, USE OF TOOLS AND TEST EQUIPMENT, AND TROUBLESHOOTING--The student will be able to:

08.01 Analyze architecture of a Microprocessor Unit (MPU).
08.02 Analyze functions of a MPU.
08.03 Analyze theory and operation of a MPU.
08.04 Analyze instruction set of a MPU.
08.05 Operate MPU system.
08.06 Write, debug, and execute programs using MPU instruction set.

08.07 Apply input//output (I/O) techniques.
08.08 Analyze MPU system hardware.
08.09 Troubleshoot MPU system hardware.
08.10 Draw and analyze MPU system interface circuits.
08.11 Construct and troubleshoot MPU system interface circuits.
08.12 Set up and operate DVM for MPU system measurements.
08.13 Set up and operate logic probes for MPU system measurements (TTL-CMOS compatible; memory; 10HZ).
08.14 Set up and operate pulser probes for MPU system measurements.
08.15 Set up and operate oscilloscopes for MPU system measurements (Minimum 60MHZ).
08.16 Set up and operate logic/data analyzers for MPU system measurements (Minimum 16 channels).
08.17 Set up and operate pulse generators for MPU system measurements.
08.18 Set up and operate frequency counters for MPU system menasurements (0-20 MHZ).

09.0 DEMONSTRATE PROFICIENCY IN PREPARING TECHNICAL RECORDS AND REPORTS--The student will be able to:

09.01 Prepare equipment performance reports using manufacturing data and systems specifications.
09.02 Requisition electronics components.

10.0 IDENTIFY, USE, AND MAINTAIN LASERS AND LASER SYSTEMS--The student will be able to:

10.01 Perform and demonstrate laser safety practices.
10.02 Define and analyze the elements and operation of a laser.
10.03 Analyze, demonstrate the use and operation of a power meter.
10.04 Demonstrate and perform the cleaning of optical materials.
10.05 Identify and demonstrate the use of component supports.
10.06 Analyze, demonstrate the use of filters and beamsplitters.
10.07 Define, analyze the properties of light.
10.08 Measure, analyze the emission and absorption of light.
10.09 Identify and analyze lasing action.
10.10 Identify, analyze and define optical cavities and modes of oscillation

11.0 DEMONSTRATE AND PRACTICE THE USES OF OPTICAL ELEMENTS--The student will be able to:

11.01 Describe and analyze temporal characteristics.
11.02 Describe and analyze spatial characteristics.
11.03 Perform and analyze the characteristics of a gas laser.
11.04 Define laser classifications and characteristics.
11.05 Demonstrate reflection and ray tracing.
11.06 Demonstrate principles of refraction.
11.07 Demonstrate refraction and ray tracing.
11.08 Demonstrate imaging with a single lens.
11.09 Demonstrate imaging with a multiple lens.
11.10 Demonstrate the effect of F-stop and aperatures.
11.11 Construct and demonstrate the use of an optical system.

12.0 DEMONSTRATE AND ANALYZE WAVE OPTICAL SYSTEMS--The student will be able to:

12.01 Identify and analyze light sources and their characteristics.
12.02 Define and describe the quantities of radiometric and photometric in the radiation of energy/power.
12.03 Describe and define the wave nature of light.
12.04 Demonstrate the effects of reflection and refraction.
12.05 Demonstrate the effects of propagation of light.
12.06 Demonstrate the interference of light.
12.07 Demonstrate the diffraction of light.
12.08 Demonstrate the polarization of light.
12.09 Demonstrate and use polarizers.
12.10 Demonstrate and construct a holography system.

13.0 PERFORM LASER TECHNOLOGY APPLICATIONS--The student will be able to:

13.01 Describe the operation, characteristics, and components required to accomplish laser welding.
13.02 Demonstrate the dynamic cutting and drilling.
13.03 Demonstrate and define the use of data recordings and manipulating.
13.04 Demonstrate and define environmental testing and monitoring.
13.05 Demonstrate and define nondestructive testing.
13.06 Demonstrate and define range finding.
13.07 Demonstrate and define alignment and angle testing.
13.08 Define and demonstrate lasers in medicine, surgery and dentistry.
13.09 Demonstrate, perform and construct laser communication system.
13.10 Demonstrate and define lasers in construction.

14.0 CALIBRATE, TROUBLESHOOT, ANALYZE LASER PERIPHERAL COMPONENTS--The student will be able to:

14.01 Define different properties and types of optical materials.
14.02 Define and demonstrate the limitations of optical materials.
14.03 Define and demonstrate windows and flats.
14.04 Define and demonstrate mirrors and etalons.
14.05 Demonstrate and analyze prisms.
14.06 Demonstrate and analyze the use of lenses.
14.07 Demonstrate and analyze the use of gratings.
14.08 Demonstrate and define non-linear materials.
14.09 Demonstrate the use of beam expanders and spatial filters.
14.10 Demonstrate the use of isolators.
14.11 Demonstrate and define spatial resolution of optical systems.

15.0 DEMONSTRATE AND PRACTICE LASER ENERGY APPLICATIONS--The student will be able to:

15.01 Demonstrate and define laser safety, hazards and evaluation.
15.02 Troubleshoot and analyze pulsed laser flashlamps and power supplies.
15.03 Toubleshoot and perform the use of power sources of CW lasers.

15.04 Troubleshoot and perform the use of CW solid lasers-efficiency and cooling.
15.05 Troubleshoot and perform laser power and energy management.
15.06 Demonstrate and perform laser beam divergence and focusing.
15.07 Troubleshoot and define optically pumped CW solid lasers.
15.08 Troubleshoot and define optically pumped pulsed solid lasers.
15.09 Troubleshoot and define laser Q-switching.
15.10 Demonstrate and define semiconductor lasers.

16.0 ANALYZE CONSTRUCT AND DEMONSTRATE LASER OPTICAL MEASUREMENTS--The student will be able to:

16.01 Demonstrate and analyze electro-optic modulator.
16.02 Demonstrate and analyze acousto-optic devices.
16.03 Demonstrate and define mode-locking.
16.04 Construct and analyze wave characteristics by using various interferometers.*

17.0 DEMONSTRATE EMPLOYABILITY SKILLS--The student will be able to:

17.01 Conduct a job search.
17.02 Secure information about a job.
17.03 Identify documents which may be required when applying for a job interview.
17.04 Complete a job application form correctly.
17.05 Demonstrate competence in job interview techniques.
17.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other employees.
17.07 Identify acceptable work habits.
17.08 Demonstrate knowledge of how to make job changes appropriately.
17.09 Demonstrate acceptable employee health habits.

Task Listings

The next several pages contain examples of task listings that have been developed at various schools. These samples are included to illustrate how different schools develop task listings.

TSTI AMARILLO

TASK LISTING

PROGRAM: Feedmill and Elevator Technology

TASK NO.	STD. HRS.	
DUTY A		Maintaining Electrical Equipment
01		Install simple electrical loads & switches
02		Compute wire, conduit & electrical box sizes
03		Troubleshoot over-current protection devices
04		Troubleshoot single phase motors
05		Troubleshoot three phase motors
06		Troubleshoot electro-mechanical relays
07		Troubleshoot solid-state relays
08		Troubleshoot electro-mechanical motor starters
09		Troubleshoot solid-state motor starters
10		Troubleshoot simple electrical control circuits
11		Troubleshoot complex multi-station control circuits
12		Troubleshoot computer controlled control circuits
13		Remove, repair or replace mechanical limit switches
14		Remove, repair or replace level control devices
15		Remove, repair or replace flow control devices
16		Remove, repair or replace electrical clutches
17		Troubleshoot motors using a megohm meter(megger)
18		Troubleshoot electric circuits using a megohm meter
19		Operate, maintain & repair electronic weighing devices
20		Operate, maintain & repair electronic load cells

TOTAL TASKS	TOTAL STD HRS	REVISED:

TSTI AMARILLO

TASK LISTING

PROGRAM: Feedmill and Elevator Technology

TASK NO.	STD. HRS.	
DUTY B		Maintaining Mechanical Systems
01		Align & tension a belt drive
02		Maintain belt drives
03		Construct belt joints using mechanical fasteners
04		Install, align & tension a chain & sprocket drive
05		Maintain chain & sprocket drive
06		Maintain and align closed gear drives
07		Maintain gear drives
08		Install & align flexible couplings
09		Remove & replace a bearing seal
10		Remove & install a mechanical seal
11		Remove & replace packing in a stuffing box
12		Align pillow block bearings
13		Install pillow block bearings
14		Remove & install rolling element bearings
15		Remove & install sleeve bearings
16		Remove & install split sleeve bearings
17		Remove & install precision fit sleeve bearings
18		Operate, maintain & repair auger conveyors
19		Operate, maintain & repair bucket elevating conveyors
20		Operate, maintain & repair belt conveyors
21		Operate, maintain & repair drag chain conveyors
22		Operate & maintain beam balance scales
23		Operate & maintain load cell weighing devices
24		Operate & maintain mobile weighing equipment such as load cells
25		Operate, maintain & repair centrifugal pumps
26		Perform drill & tap operations
27		Remove broken bolts from equipment

TOTAL TASKS	TOTAL STD HRS	REVISED:

Task List

TASK #	HRS.	WRITTEN MASTERY	PERFORMANCE MASTERY	DUTY/TASK
DUTY A				MATH
1				Read and write whole numbers
2				Add whole numbers
3				Subtract whole numbers
4				Multiply whole numbers
5				Divide whole numbers
6				Change a fraction to an equivalent one
7				Change an improper fraction to a mixed one
8				Change a mixed number to an improper fraction
9				Add fractions
10				Subtract fractions
11				Multiply fractions
12				Divide fractions
13				Read and write decimal numbers
14				Round off decimal numbers
15				Add decimals
16				Subtract decimals
17				Multiply decimals
18				Divide decimals
19				Change a fraction to a decimal
20				Set up a ratio
21				Solve a proportion
22				Find percentage of a number
23				Find what percent one number is of another
24				Solve a word problem using percents
25				Add integers
26				Subtract integers
27				Multiply integers
28				Divide integers
29				Compute numbers having positive and negative exponents
30				Express a number in Scientific Notation
31				Simplify an expression containing exponents, variables, and grouping symbols
32				Add binomials
33				Subtract binomials
34				Multiply binomials
35				Divide binomials
36				Add polynomials
37				Subtract polynomials
38				Multiply polynomials
39				Divide polynomials

TASK #	HRS.	WRITTEN MASTERY	PERFORMANCE MASTERY	DUTY/TASK
40				Solve an equation with one variable in the first degree
41				Solve an equation containing fractional expressions
42				Find the square root of a square number
43				Find the cubic root of a cubic number
44				Change an equation from one form to another
45				Solve for one varible in terms of another
46				Change from one unit of Metric Measurement to another
47				Find the third side of a right triangle
48				Find sine, cosine, or tangent of any angle
DUTY B				**READING**
1				Follow written directions
2				Identify basic vocabulary words
3				Use the parts of a book
4				Use a dictionary
5				Read material and find the facts
6				Use the library
7				Use the encyclopedia
8				Read a map
9				Organize ideas from a written passage
10				Make the right conclusions from a written passage
11				Get the main idea from a written passage
12				Increase speed with comprehension
DUTY C				**LANGUAGE**
1				Spell words correctly
2				Capitalize and punctuate sentences
3				Capitalize proper nouns and titles
4				Use the correct form of verbs
5				Use the correct form of pronouns
6				Identify the parts of speech
7				Recognize a complete sentence
DUTY D				**COMPLIMENTARY SKILLS**
1				Develop a positive self image
2				Develop a positive attitude towards school
3				Work well with others
4				Develop better study habits
5				Build vocabulary

WORD PROCESSING OPERATOR

SKILL PROFILE

	Category	-Competencies-						
A	DEMOSTRATE SECRETARIAL SKILLS	A-1 Follow Directions	A-2 Exemplify Professionalism	A-3 Proofread and Edit	A-4 Follow Company Policies and Procedures	A-5 Spell	A-6 Punctuate Properly	A-7 Use Proper Grammer
		A-8 Use Basic Math	A-9 Use Basic Office Equipment	A-10 Transcribe from Dictation Equipment	A-11 Utilize Reference Manuals (Dictionaries)	A-12 Perform Basic Receptionist Duties	A-13 Demonstrate Proper Phone Handling Techniques	
		A-14 Apply Appropriate Format	A-15 Use Equipment and supplies Carefully	A-16 Maintain Calendar	A-17 Compile Information	A-18 Explain Organizational Chart	A-19 Be Flexible	A-20 Demonstrates Self-Reliance
		A-21 Display Initiative	A-22 Keep Abreast of Trends and Technology	A-23 Demonstrate Responsibility	A-24 Establish and Maintain Filing System	A-25 Practice Confidentiality		
B	TYPE/KEYBOARD	B-1 Demonstrate Proper Keystroking	B-2 Demonstrate Mastery of Numerical Keystroking	B-3 Demonstrate 60 WPM Keyboarding Speed (Corrected)	B-4 Identify and Use Specialized Keys	B-5 Format and Layout	B-6 Use Appropriate Commands	
		B-7 Design Graphics and Forms	B-8 Demonstrate Required Level of Productivity					
C	OPERATE EQUIPMENT	C-1 Demonstrate Start-up Procedure	C-2 Demonstrate Shut-Down Procedure	C-3 Demonstrate Power Loss Procedure	C-4 Demonstrate Printing Process	C-5 Demonstrate Archive/Retrieval Process	C-6 Demonstrate Optimum Equipment Capability	
		C-7 Perform Simple Preventive Maintenance	C-8 Utilize Equipment Reference Manuals	C-9 Follow Safety/Health Rules	C-10 Operate Peripheral Equipment	C-11 Use Communications Capabilities	C-12 Follow Security Procedures	
D	ORGANIZE/ COORDINATE	D-1 Maintain Supply Levels	D-2 Organize Work Station	D-3 Maintain Electronic Filing System	D-4 Set Up Indexes	D-5 Organize Media Storage	D-6 Set Up Media Filing	D-7 Schedule Time
E	COMMUNICATE	E-1 Demonstrate Proficient Use of Voabulary/ Job Terminology	E-2 Listen	E-3 Speak Clearly	E-4 Read and Comprehend	E-5 Use Techniques of Good Writing	E-6 Educate Users	
F	MAINTAIN INTERPERSONAL RELATIONSHIPS	F-1 Respect Others	F-2 Adapt to Personality Differences	F-3 Display Interest in Self Development	F-4 Minimize Stress	F-5 Demonstrate Versatility	F-6 Utilize Team Approaches	

Beaufort Technical College
Beaufort, SC 29902

THE NATIONAL CENTER
FOR RESEARCH IN VOCATIONAL EDUCATION

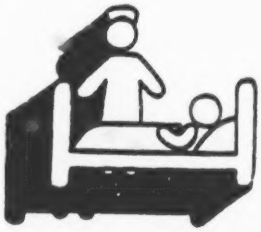
LEGAL ASSISTANT

DUTIES	TASKS													
Assist Clients	Establish Firm/Client Rapport	Record Interview Data	Gather Information	Analyze Information	Inventory Assets and Liabilities	Assist in Establishing Record Keeping Procedures for Clients	Monitor Contacts for Effective Use of Attorney Time							
Perform Communications Functions	Make Phone Calls	Arrange for Appointments and Meetings	Coordinate Meetings and Conferences	Consult with Officers of the Court	Consult with Administrative Agencies	Consult with Resource Persons	Draft Correspondence	Prepare Correspondence	Draft Memoranda	Write Memoranda	Employ Public Relations Techniques	Act as Inter-office Personnel Liaison	Keep Clients Informed	
Implement Legal Procedures	Obtain Signatures	Perform Notary Services	File Pleadings and/or Documents	Lodge Pleadings and/or Documents	Record Instruments and/or Documents	Give Notices	Monitor Services of Process	Set Hearing and/or Trial Dates	Obtain Issuance of Documents					
Perform Investigative Functions	Obtain Reports	Conduct Non-legal Research	Gather Physical Evidence	Locate Persons	Locate Properties	Interview Witnesses	Check Accuracy and Consistency of Information	Verify Assets and Liabilities	Obtain Valuations of Assets and Liabilities	Assist with Depositions	Digest Materials	Classify Materials		
Perform Legal Research	Retrieve Previously Researched Information	Use Library and Other Relevant Resources	Locate Relevent Statutory Law	Locate Relevent Administrative Law	Locate Relevant Municipal Ordinances	Locate Relevant Legislative Histories	Locate Relevant Case Law	Shepardize Cases and Statutes	Digest Materials	Classify Materials	Draft Memoranda	Prepare Memoranda	Draft Briefs	Prepare Briefs
Prepare Instruments and Documents	Research Form Files	Compile and Compute Data	Draft Instruments	Prepare Instruments	Draft Pleadings	Prepare Pleadings	Draft Documents	Prepare Documents	Check Drafts for Modification	Make Revisions of Documents	Complete Prepared Forms	Proofread Written Materials		
Assist with Judicial and Administrative Appearances	Prepare Trial Notebooks	Prepare Case Law Notebooks	Organize Files	Schedule Witnesses	Subpoena Witnesses	Maintain Exhibit Indexes	Maintain Checklist of Subpoenaed Items	Prepare Visual Aids	Prepare Demonstrative Evidence	Take Extensive Notes	Perform Emergency Research	Acquaint Witnesses or Clients with Court Procedures	Assemble and Transport Relevent Materials	Open Informal Court Proceedings for Estates
Complete Client Projects	Conduct Real Estate Closings	Transfer Assets	Close Estates	Assist in Pursuit of Post-Trial Remedies	Complete Post Trial Wrap-ups	Collect and Return Exhibits	Prepare Withdrawals as Attorney of Records	Close Client Files						
Continue Education	Participate in Educational Courses and Programs	Participate in Seminars, Conferences and Workshops	Complete Required Readings	Read Current Publications	Interact with Other Professionals	Participate in Professional Organizations	Participate in Legal Assistance Projects							
Coordinate Office Functions	Open Client Files	Maintain Office Equipment	Arrange for Maintenance of Office Equipment	Maintain Time Records	Update Library Materials	Maintain Form Files	Maintain Filing Systems	Maintain Inventory Controls	Maintain Calendar Controls	Categorize Client Records	Screen Office Contacts	Prepare Client Billings	Maintian Office Accounting	Maintain Research Files
	Develop Legal Procedures Handbook	Monitor Legal Procedures Handbook	Prepare Inter-office Memos	Recruit Potential Employees	Interview Potential Employees	Orient New Staff to Office Procedures	Train Non-legal Personnel	Supervise Non-legal Personnel	Assist in the Evaluation of Personnel					

Adapted from DACUM Analysis Conducted for
CURRICULUM MATERIALS SERVICE
Department of Vocational Education
Colorado State University

PVTI

Practical Nursing



Task Listing For Practical Nursing

DUTY A Orienting to Practical Nursing
  1. recognize program policies
  2. recognize role of a practical nurse
  3. communicate with patients
  4. observe and assess patients
  5. record on a patient's chart

DUTY B Providing Patient Care (personal)
  1. assist with bed bath, back rub, shower, tub bath
  2. maintain oral hygiene
  3. assist with personal grooming
  4. assist in using bedpan, urinal, and bedside commode.
  5. serve trays and feed patients
  6. assist handicapped patients
  7. admit, transfer, and discharge patients

DUTY C Performing Comfort and Safety Measures
  1. apply principles of body mechanics
  2. turn and position patients
  3. assist patients to dangle and ambulate
  4. transfer and transport a patient by wheelchair and stretcher
  5. assist with the use of devices for support and ambulation
  6. utilize devices to prevent complications of immobility
  7. apply restraints
  8. practice evacuation procedures
  9. prepare incident reports

DUTY D Performing Aseptic Techniques

1. apply principles of medical asepsis
2. apply principles of surgical asepsis
3. perform isolation techniques

DUTY E Administering Treatments

1. apply heat and cold
2. give enemas
3. apply binders and bandages
4. care for respiratory needs
5. perform oral-nasal suctioning
6. assist patients with range of motion exercises
7. care for urinary catheters
8. insert, remove, & irrigate urinary catheters
9. administer gavage feedings & irrigate nasogastric tube
10. clean inner cannula & suction tracheostomy
11. give perineal care or vaginal irrigation
12. irrigate colostomy & change dressing
13. apply sterile dressings
14. irrigate bladder & wound
15. perform accuchecks

DUTY F Conducting Nursing Procedures

1. make & adjust hospital beds
2. assist with physical examinations
3. measure & record vital signs
4. measure & record intake & output
5. collect routine specimens
6. perform urine & stool tests
7. prepare for & assist with special procedures & diagnostic tests
8. manage & monitor I.V. infusions
9. inventory & requisition equipment & supplies
10. collect sterile specimens
11. perform pre-operative & post-operative care
12. assist with post-mortem care

DUTY G Administering Medication

1. calculate dosages
2. recognize medication-classifications, actions, & nursing implications
3. apply guidelines for administering medications
4. inventory medicines
5. give oral medications
6. give parenteral medications
7. apply topical, rectal & vaginal medications

DUTY H Caring for Obstetric and Newborn Patients

1. care of prenatal patients
2. care for patients during labor & delivery
3. care for post-partem patients
4. provide immediate post delivery care of the infant
5. provide care for newborns
6. assist with feeding of infants

DUTY I Caring for Infants & Children

1. prepare children/families for hospitalization
2. identify diseases & disorders specific to children & their nursing implications
3. adapt nursing procedures to care for infants/children
4. care for longterm, handicapped, or dying infants & children

DUTY J Providing Emergency Care

1. administer CPR
2. administer first aid

DUTY K Performing Medical/Surgical Nursing

1. care for geriatric patients
2. care for patients with diseases & disorders of the muscular skeletal system
3. care for patients with diseases & disorders of the endocrine system
4. care for patients with diseases & disorders of the digestive system
5. care for patients with diseases & disorders of the urinary system
6. care for patients with diseases & disorders of the circulatory system
7. care for patients with diseases & disorders of the respiratory system
8. care for patients with diseases & disorders of the sensory and nervous system
9. care for patients with diseases & disorders of the skin
10. care for patients with diseases & disorders of the reproductive system

Task Listing **SPVTI**

FILE CLERK
7660-03

DUTY TASK NO.	AVERAGE HOURS	TASK
0300		TYPEWRITING, BEGINNING
0303	30	Type alpha keys/correct techniques: 20 wpm/2 min/4 err
0306	10	Type centering problems
0309	10	Build skill: 25 wpm/2 min/4 err
0312	18	Type number and symbol keys: 30 wpm/3 min/5 err
0315	18	Type enumeration problems
0318	8	Type blocked letters
0321	2	Correct errors by erasing
0324	9	Type tabulated problems
0327	15	Build skill: 30 wpm/4 min/5 err
1200		BUSINESS RECORDS
1203	5	Prepare general bank records
1206	5	Identify basic terms & concepts of bus. data processing
1500		TELEPHONE TECHNIQUES
1503	5	Identify correct telephone procedures/techniques/services
1800		JOB EXPLORATION
1803	3	Identify job opportunities for beginning office workers
1806	3	Contrast the two types of internal organization structures
1809	12	Complete general clerical simulation
1812	12	Complete secretarial/stenographic simulation
1815	4	Complete accounting/data processing simulation
2100		EMPLOYABILITY SKILLS
2103	5	Complete steps in the employment process
2106	3	Recognize positive job attitudes
2109	3	Solve human relations problems
2400		MATH COMPUTATIONS/MACHINES
2403	15	Operate a ten-key adding machine
2406	15	Operate an electric printing calculator
2409	10	Operate an electronic display calculator

PROGRAM TASK LISTING 0215L RVTC

TASK	HOURS	8709100 BASIC AUTOMOTIVE MECHANICS AER0990 AUTOMOTIVE MECHANICS - 945 Hours
		COURSES Applicable to High School Students Only! 8709110 BASIC AUTOMOTIVE MECHANICS 1 8709120 BASIC AUTOMOTIVE MECHANICS 2 8709130 BASIC AUTOMOTIVE MECHANICS 3 8709140 BASIC AUTOMOTIVE MECHANICS 4 8709150 BASIC AUTOMOTIVE MECHANICS 5 8709160 BASIC AUTOMOTIVE MECHANICS 6
A	83	PARTICIPATING IN ORIENTATION TO RVTC
01	7	Complete orientation to CBVE
02	3	Complete orientation to work habits and attitudes
03	12	Identify hand tools and their use
04	15	Identify safety procedures in the shop
05	12	Identify fasteners, grades and bolts and their use
06	16	Read scales of various measuring instruments
07	10	Identify metric units
08	8	Work on special assignments (Optional)
B	207	PERFORMING MAINTENANCE AND REPAIR ON DRIVE TRAIN
01	15	Service tires
02	35	Repair drive line
03	20	Service automatic transmission
04	30	Perform chassis maintenance and inspection
05	20	Repair exhaust system
06	25	Identify engine components
07	20	Test cooling system
08	3	Recognize welding safety practices
09	2	Operate a Beseler Cue/See projector
10	5	Cut mild steel using oxyacetylene equipment
11	15	Braze with the oxyacetylene equipment
12	17	Work on special assignments (Optional)
C	270	TROUBLESHOOTING AND REPAIRING ELECTRICAL SYSTEM
01	25	Identify fundamentals of electricity
02	15	Performance test automotive batteries
03	15	Test cranking system
04	20	Test charging system with volt-amp tester
05	30	Repair charging system
06	20	Disassemble and reassemble ignition components
07	35	Repair ignition system problems
08	15	Describe scope hookup and patterns
09	42	Interpret scope patterns
10	25	Perform minor tune-up
11	28	Work on special assignments (Optional)
D	143	REPAIRING MINOR ENGINE PROBLEMS
01	10	Identify fuel system components
02	15	Identify carburetor operation

cont.

PROGRAM TASK LISTING

RVTC

TASK	HOURS	8709100 BASIC AUTOMOTIVE MECHANICS AER0990 AUTOMOTIVE MECHANICS
03	20	Service the fuel and carburetion system
04	25	Rebuild common carburetors
05	25	Identify emission control units
06	35	Diagnose the mechanical condition of an engine
07	13	Work on special assignments (Optional)
E	66	REPAIRING AND MAINTAINING BRAKES
01	20	Identify brake components
02	40	Recondition brake system
03	6	Work on special assignments (Optional)
F	99	REPAIRING AND MAINTAINING FRONT END
01	10	Identify steering and suspension system components
02	40	Repair front end
03	10	Balance tires
04	10	Identify alignment angles
05	20	Align front end
06	9	Work on special assignments (Optional)
G	174	SERVICING AUTOMOTIVE DIESEL ENGINES
01	18	Identify basic diesel fundamentals
02	12	Test diesel engine compression
03	12	Set automotive diesel engine timing
04	12	Diagnose starting or rough idling problems
05	12	Remove and install injector pump
06	12	Inspect engine lubrication system
07	12	Adjust valves
08	12	Service injectors and injector lines
09	24	Remove and install cylinder head
10	20	Replace oil pump and vacuum pump
11	6	Test injector pump housing fuel pressure
12	6	Replace fuel pump and filter
13	16	Work on special assignments (Optional)
TOTAL	1042	
H	350	PERFORMING ENGINE OVERHAUL
01	25	Remove engine from vehicle
02	10	Steam clean an engine
03	30	Disassemble engine
04	30	Clean and check condition of engine parts
05	30	Grind valves
06	15	Hone engine cylinders
07	20	Check piston to cylinder fit
08	30	Replace crankshaft and main bearings
09	20	Replace pistons
10	10	Inspect operation of oil pump
11	20	Replace camshaft

cont.

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PROGRAM TASK LISTING

TASK	HOURS	8709100 BASIC AUTOMOTIVE MECHANICS AER0990 AUTOMOTIVE MECHANICS
12	20	Replace connecting rods and bearings
13	10	Inspect head for warpage and cracks
14	10	Torque cylinder head bolts
15	15	Adjust valves
16	10	Replace coolant freeze plugs
17	15	Perform operational inspection on P.C.V. system
18	15	Replace piston rings
19	15	Work on special assignments (Optional)
I	265	MAINTAINING AND REPAIRING TRANSMISSIONS
01	5	Perform operational tests on automatic transmission
02	5	Clean and inspect transmission
03	5	Adjust floor linkage
04	5	Adjust column-type linkage
05	5	Adjust linkage from engine to automatic transmission
06	5	Adjust or replace modulator
07	15	Adjust or replace neutral safety switch
08	20	Make band adjustments (internal or external)
09	20	Replace seals, gaskets and lines on automatic transmissions
10	15	Inspect, repair or replace transmission cooling systems
11	15	Remove and install automatic transmission
12	15	Inspect, remove and replace converter
13	20	Inspect and replace front pump seal and bushings
14	15	Adjust clutch
15	15	Replace clutch release bearings
16	20	Replace mechanical type clutch
17	20	Replace pilot bearing
18	15	Replace manual transmission rear seal, gasket and bearings
19	15	Replace manual transmission
20	15	Work on special assignments (Optional)
J	240	MAINTAINING AUTOMOBILE AIR CONDITIONERS AND HEATERS
01	25	Identify air conditioning components
02	20	Leak test air conditioning system
03	30	Identify the theory and function of automobile air conditioning
04	25	Inspect and recharge air conditioning system
05	10	Diagnose heating system problems
06	20	Evacuate air conditioning system
07	20	Diagnose air conditioning system malfunctions
08	20	Replace air conditioning fan motor
09	20	Repair vacuum circuit in air conditioning system
10	10	Service air conditioning control cables
11	10	Service heater control components
12	10	Replace defroster hoses
13	10	Replace air conditioning drive clutch
14	10	Work on special assignments (Optional)
		cont.

PROGRAM TASK LISTING

RVTC

TASK	HOURS	8709100 BASIC AUTOMOTIVE MECHANICS AER0990 AUTOMOTIVE MECHANICS
K	90	PERFORMING DIFFERENTIAL REPAIR AND MAINTENANCE
01	20	Describe the principle operations of differential
02	15	Identify components of a standard and limited slip differential
03	20	Disassemble and inspect a differential for worn or damaged parts
04	30	Reassemble and adjust a differential
05	5	Work on special assignments (Optional)
L	100	MAINTAINING COMPUTER ENGINE CONTROL SYSTEMS
01	2	Use Atech Competency Based Units
02	3	Understand EFI overview
03	3	Diagnose oxygen sensor circuit
04	3	Perform coolant temperature sensor diagnosis
05	3	Perform manifold absolute pressure tests
06	4	Test throttle position sensor circuit
07	3	Test tachometer sensor
08	4	Test vehicle speed sensor
09	6	Test control switches
10	10	Test electronic control module
11	10	Test fuel supply components
12	7	Test fuel injectors
13	6	Test idle air control system
14	10	Test electronic spark timing
15	10	Test transmission converter
16	6	Test AC clutch control clutch circuit
17	10	Test engine light circuit (Optional)
Z	50	The task below is OPTIONAL
01	50	Participate in VICA
TOTAL	2137	Michael Taylor Reginald Flowers Revised 9/3/86

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INDUSTRIAL EDUCATION DIVISION

DEPARTMENT TASK LISTINGS

WELDING

Program 1042 Tasks 050 - 099 BASIC ARC WELDING--MAINTENANCE

Task No.	Standard Hours	Mastery Hours	Instructor Initials	Task Description
071	18	---	---	WELD LAP JOINTS ON 3/8" MILD STEEL PLATE IN THE FLAT, VERTICAL AND OVERHEAD POSITIONS (1F, 3F, 4F)
074	6	---	---	PERFORM DYE PENETRANT TESTS ON WELDS TO CHECK QUALITY
077	18	---	---	WELD TEE JOINTS ON 3/8" MILD STEEL PLATE IN THE FLAT, VERTICAL AND OVERHEAD POSITIONS (1F, 3F, 4F)
080	6	---	---	PERFORM PRODUCTION TEST ON 3/8" PLATE TEE JOINTS IN THE 3F AND 4F POSITIONS (DYE PENETRANT TEST)
083	11	---	---	HARD- FACE MATERIALS-SMAW

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INDUSTRIAL EDUCATION DIVISION

DEPARTMENT TASK LISTINGS

WELDING

Program 1043   Tasks 100 - 149   OXY-ACET WELDING & BRAZING--MAINTENANCE

Task No.	Standard Hours	Mastery Hours	Instructor Initials	Task Description
100	20	----	----	WELD 1/8" MILD STEEL IN THE FLAT POSITION WITH OXY-ACETYLENE WELDING EQUIPMENT (1F)
103	20	----	----	WELD 1/8" MILD STEEL IN THE HORIZONTAL POSITION WITH OXY-ACETYLENE WELDING EQUIPMENT (2F)
106	20	----	----	WELD 1/8" MILD STEEL IN THE VERTICAL POSITION WITH OXY-ACETYLENE EQUIPMENT (3F)
109	20	----	----	WELD 2" SCH. 40 MILD STEEL PIPE IN THE 6G POSITION
112	10	----	----	BRAZE MILD STEEL
115	5	----	----	OPERATE (ROSE-BUD) HEATING EQUIPMENT
118	25	----	----	SILVER BRAZE BRASS, COPPER AND STAINLESS STEEL.

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INDUSTRIAL EDUCATION DIVISION

DEPARTMENT TASK LISTINGS

WELDING

Program 1046   Tasks 250 - 299   ARC WELDING-VEE BUTT I

Task No.	Standard Hours	Mastery Hours	Instructor Initials	Task Description
250	20	____	____	WELD SINGLE VEE BUTT JOINT ON 3/8" MILD STEEL PLATE IN FLAT POSITION (1G)
253	6	____	____	PERFORM PRODUCTION TEST ON 3/8" PLATE JOINTS IN THE (1G) POSTION (GUIDED BEND AND RADIOGRAPHIC TESTS)
256	34	____	____	WELD SINGLE VEE BUTT JOINT ON 3/8" MILD STEEL PLATE IN THE VERTICAL POSITION (3G)-UPHILL STRINGER, DOWN HILL HOT PASS,
259	30	____	____	WELD SINGLE VEE BUTT JOINTS ON 1/2" MILD STEEL PLATE IN THE VERTICAL POSITION (3G)-OPEN BUTT UP HILL STRINGER, DOWN HILL HOT PASS
262	30	____	____	WELD SINGLE VEE BUTT JOINTS ON 1/2" MILD STEEL PLATE IN THE VERTICAL POSITION (3G)-BACKUP STRIP, UP HILL

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INDUSTRIAL EDUCATION DIVISION

DEPARTMENT TASK LISTINGS

WELDING

Program 1052   Tasks 550 - 599 ALLOY WELDING I-MIG

Task No.	Standard Hours	Mastery Hours	Instructor Initials	Task Description
550	12	----	-----	WELD 1/8" & 1/4" STAINLESS STEEL PLATE IN THE FLAT, VERTICAL AND OVERHEAD POSITIONS (1F, 3F, 4F) - TEE JOINTS
553	12	----	-----	WELD 8" & 10" SCH 40 STAINLESS STEEL PIPE IN THE 1G POSITION (ROLL OUT)
556	12	----	-----	WELD 8" & 10" SCH 40 STAINLESS STEEL PIPE IN THE QUARTER WELDING POSITION
559	12	----	-----	WELD 8" & 10" SCH 40 STAINLESS STEEL PIPE IN THE HORIZONTAL POSITION 2G
562	12	----	-----	WELD 1/8 AND 1/4 INCH ALUMINUM PLATE IN THE FLAT, VERTICAL AND OVERHEAD POSITIONS (1F, 3F, 4F)-TEE JOINTS
565	12	----	-----	WELD 6" & 8" SCH 40 PIPE IN THE 1G ROLL OUT POSITION
568	12	----	-----	WELD 6" & 8" SCH 40 ALUMINUM PIPE IN THE QUARTER WELD POSITION.
571	12	----	-----	WELD 6" & 8" SCH 40 ALUMINUM PIPE IN THE OVERHEAD POSITION 5G
574	12	----	-----	WELD 6" & 8" SCH 40 ALUMINUM PIPE IN THE HORIZONTAL POSITION 2G
577	12	----	-----	WELD 6" & 8" SCH 40 ALUMINUM PIPE IN THE 6G POSITION

AREA: RESPIRATORY THERAPY TECHNOLOGY

			R.T. TECH.	BLOOD GAS TECH.	EQUIP. TECH.
DUTY #1:		MANAGING PATIENT DATA			
TASKS:	1.	Review a patient's chart	*	*	*
	2.	Confirm a physician's order	*	*	*
	3.	Legally identify a patient	*	*	*
	4.	Document informed consent	*	*	*
	5.	Record data on medical record	*	*	*
	6.	Report adverse reactions	*	*	*
DUTY #2:		PERFORMING INFECTION CONTROL PROCEDURES			
TASKS:	1.	Handwash	*	*	*
	2.	Put on sterile apparel	*	*	*
	3.	Put on isolation apparel	*	*	*
	4.	Double-bag contaminated equip.	*	*	*
	5.	Clean and sterilize equip.	*	*	*
	6.	Maintain sterilization records	*	*	*
DUTY #3:		ASSESSING VITAL FUNCTIONS			
TASKS:	1.	Measure oral temperature	*	*	*
	2.	Assess radial pulse	*	*	*
	3.	Measure blood pressure	*	*	*
	4.	Evaluate respirations	*	*	*
	5.	Perform chest auscultation	*	*	*
DUTY #4:		PROVIDING MEDICAL GAS THERAPY			
TASKS:	1.	Identify cylinders by markings	*	*	*
	2.	Attach cylinder regulators	*	*	*
	3.	Transport cylinders	*	*	*
	4.	Administer Oxygen (O_2) via cannula	*		
	5.	Administer O_2 via catheter	*		
	6.	Administer O_2 via simple mask	*		
	7.	Administer O_2 via partial and non-rebreathing masks	*		
	8.	Administer O_2 via high flow entrainment mask (Venturi type)	*		
	9.	Analyze delivered O_2 concentration	*	*	
	10.	Administer Helium/O_2 mixtures	*		
	11.	Administer CO/O_2 mixtures	*		
DUTY #5:		ADMINISTERING AEROSOL/HUMIDITY THERAPY			
TASKS:	1.	Deliver aerosol/humidity via pediatric tent (canopy)	*		
	2.	Deliver continuous aerosol via jet nebulizer (cold/heated)	*		

Task Surveys

Several examples of task surveys are included on the following pages for your review. Samples of different formats are included.

TSTI

Diesel Mechanics Technology Task Inventory

SCALES	Performed	-P	Circle one
	Not performed	-N	
	Low	-1	Circle one
	Medium	-2	
	High	-3	

Directions for Completing Task Inventory Survey

If a particular task is not performed in your business, please circle only "N" and go to the next question. If a task is performed, circle "P" and answer the "Frequency", "Importance", and "Difficulty" sections of the survey. Please use the following descriptions in marking your responses:

TASK FREQUENCY
1. Tasks rated low in frequency are usually performed once each month or less.
2. Tasks rated medium in frequency are usually performed once each week or less.
3. Tasks rated high in frequency are generally performed on a daily basis.

TASK IMPORTANCE
1. Tasks rated as having low importance are performed, but they are of minor importance and have a low priority.
2. Tasks rated as having medium importance are not critical, but they are often given priority over other tasks. Inadequate performance of this task CAN seriously impact product or service.
3. Tasks rated high in importance are critical and have the highest priority. Inadequate performance of this task WILL have serious impact on product or services.

TASK DIFFICULTY
1. Tasks having low difficulty rating are easy to perform, are of minimal complexity, and little practice is required to maintain competency.
2. Tasks rated medium in difficulty are complex, require considerable knowledge and must have practice to maintain competency.
3. Tasks rated high in difficulty are very complex, performed to exacting standards, and require continual practice in order to maintain competency.

Please add any items you wish in the blank spaces provided at the end of each section.

Once again we would like to thank you for completing this survey. We realize this takes a considerable amount of your valuable time, but it also assures that the Diesel Mechanics Technology program at TSTI will teach its students the skills and knowledge required by industry.

Diesel Mechanics Technology Task Inventory

Name: ______________________________

Address ______________________________

Telephone No. ______________________________

Company Title______________________________

Type of Company______________________________

Job or Position Title______________________________

Number of Employees in this Position at this Site______________

Total Number of Employees at this Site______________

Total Years in Present Job or Position______________

Total Years in Career Field______________

Number of People Currently Supervised by You______________

Date Survey Completed______________

Do you plan to hire any additional entry-level diesel mechanics in the next two years?
(Circle one) Yes No

If answer to above question is yes, how many?______

Would you be interested in serving on our advisory committee?
(Circle one) Yes No

Duty	Task	USING BASIC MECHANICS SKILLS	P	N	Frequency			Importance			Difficulty		
					1	2	3	1	2	3	1	2	3
A	01	Read and interpret diesel shop manuals	P	N	1	2	3	1	2	3	1	2	3
A	02	Identify basic hand tools and explain their uses	P	N	1	2	3	1	2	3	1	2	3
A	03	Identify various power tools and explain their uses	P	N	1	2	3	1	2	3	1	2	3
A	04	Identify various shop safety hazards and explain how to correct them	P	N	1	2	3	1	2	3	1	2	3
A	05	Use inside and outside micrometers	P	N	1	2	3	1	2	3	1	2	3
A	06	Identify various cutting tools and explain their uses	P	N	1	2	3	1	2	3	1	2	3
A	07	Identify various types of hoses, fittings, and bolts	P	N	1	2	3	1	2	3	1	2	3
A	08	Use dial indicators and precision measuring tools	P	N	1	2	3	1	2	3	1	2	3
		REPAIRING FOUR STROKE CYCLE DIESEL ENGINES											
B	01	Explain the operating principles of both four cycle and two cycle diesel engines and their components	P	N	1	2	3	1	2	3	1	2	3
B	02	Service and replace various types of filters	P	N	1	2	3	1	2	3	1	2	3
B	03	Troubleshoot and repair a diesel engine's cooling system	P	N	1	2	3	1	2	3	1	2	3
B	04	Troubleshoot and repair a diesel engine's lubrication system	P	N	1	2	3	1	2	3	1	2	3
B	05	Disassemble a diesel engine	P	N	1	2	3	1	2	3	1	2	3
B	06	Measure and inspect all engine parts	P	N	1	2	3	1	2	3	1	2	3
B	07	Recondition diesel engine parts for reuse in the engine	P	N	1	2	3	1	2	3	1	2	3
B	08	Reassemble a diesel engine block assembly	P	N	1	2	3	1	2	3	1	2	3
B	09	Overhaul a diesel engine cylinder head	P	N	1	2	3	1	2	3	1	2	3

Duty	Task	REPAIRING FOUR STROKE CYCLE DIESEL ENGINES - CONT.	P	N	Frequency 1	2	3	Importance 1	2	3	Difficulty 1	2	3
B	10	Reassemble a diesel engine and test	P	N	1	2	3	1	2	3	1	2	3
B	11	Overhaul a diesel engine in the frame	P	N	1	2	3	1	2	3	1	2	3
B	12	Perform valve, injector, and timing checks on a diesel engine	P	N	1	2	3	1	2	3	1	2	3
B	13	Overhaul a turbocharger	P	N	1	2	3	1	2	3	1	2	3
B	14	Overhaul a diesel engine blower	P	N	1	2	3	1	2	3	1	2	3
B	15	Overhaul a Cummins engine	P	N	1	2	3	1	2	3	1	2	3
B	16	Overhaul a Mack engine	P	N	1	2	3	1	2	3	1	2	3
B	17	Overhaul a Caterpillar engine	P	N	1	2	3	1	2	3	1	2	3
B	18	Overhaul a farm tractor engine	P	N	1	2	3	1	2	3	1	2	3
B	19	Remove and reinstall a diesel engine from the chassis	P	N	1	2	3	1	2	3	1	2	3
		TESTING AND REPAIRING ELECTRICAL SYSTEMS											
C	01	Identify various electrical system components and explain their function	P	N	1	2	3	1	2	3	1	2	3
C	02	Read basic wiring diagrams	P	N	1	2	3	1	2	3	1	2	3
C	03	Use various electrical system testers, volt-amp tester, ohmmeter, test light, hydrometer, etc.	P	N	1	2	3	1	2	3	1	2	3
C	04	Test and repair a diesel starting motor and its circuit	P	N	1	2	3	1	2	3	1	2	3
C	05	Test and repair a Delco-Remy alternator and its circuit	P	N	1	2	3	1	2	3	1	2	3
C	06	Test and repair a Leece-Leville alternator	P	N	1	2	3	1	2	3	1	2	3
C	07	Test and charge a battery	P	N	1	2	3	1	2	3	1	2	3
C	08	Test a charging circuit and starting circuit on the chassis	P	N	1	2	3	1	2	3	1	2	3
C	09	Test and repair a lighting circuit on the vehicle	P	N	1	2	3	1	2	3	1	2	3

Duty	Task	TESTING AND REPAIRING ELECTRICAL SYSTEMS - CONT.	P	N	Frequency			Importance			Difficulty		
					1	2	3	1	2	3	1	2	3
C	10	Test a relay and its circuit	P	N	1	2	3	1	2	3	1	2	3
C	11	Test and repair a vehicle cruise control	P	N	1	2	3	1	2	3	1	2	3
C	12	Overhaul an alternator with an external regulator	P	N	1	2	3	1	2	3	1	2	3
		REPAIRING AND TROUBLESHOOTING AIR CONDITIONING SYSTEMS											
D	01	Identify the various air-conditioning components and explain their function in the system	P	N	1	2	3	1	2	3	1	2	3
D	02	Service the air-conditioning system (charge and perform preventive maintenance)	P	N	1	2	3	1	2	3	1	2	3
D	03	Test, diagnose, and repair a basic air-conditioning system	P	N	1	2	3	1	2	3	1	2	3
D	04	Overhaul an air-conditioning compressor	P	N	1	2	3	1	2	3	1	2	3
D	05	Replace a compressor seal	P	N	1	2	3	1	2	3	1	2	3
D	06	Replace a compressor clutch	P	N	1	2	3	1	2	3	1	2	3
D	07	Test and replace trinary switches	P	N	1	2	3	1	2	3	1	2	3
		OVERHAULING TWO CYCLE DIESEL ENGINES											
E	01	Review operations and systems of a diesel engine	P	N	1	2	3	1	2	3	1	2	3
E	02	Disassemble a two cycle engine	P	N	1	2	3	1	2	3	1	2	3
E	03	Qualify and analyze parts as failed, reusable, repairable, replace	P	N	1	2	3	1	2	3	1	2	3
E	04	Assemble engine	P	N	1	2	3	1	2	3	1	2	3
E	05	Perform a major tune-up and adjust for running	P	N	1	2	3	1	2	3	1	2	3

Duty	Task	OVERHAULING TWO CYCLE DIESEL ENGINES - CONT.	P	N	Frequency			Importance			Difficulty		
					1	2	3	1	2	3	1	2	3
E	06	Operate a diesel engine and analyze its performance	P	N	1	2	3	1	2	3	1	2	3
E	07	Troubleshoot and repair a live engine with performance problems	P	N	1	2	3	1	2	3	1	2	3
		REPAIRING FUEL INJECTION SYSTEMS											
F	01	Perform preventive maintenance of the diesel fuel system	P	N	1	2	3	1	2	3	1	2	3
F	02	Describe various fuel injection components and describe their functions	P	N	1	2	3	1	2	3	1	2	3
F	03	Troubleshoot a diesel fuel system	P	N	1	2	3	1	2	3	1	2	3
F	04	Rebuild and test a Cummins fuel system	P	N	1	2	3	1	2	3	1	2	3
F	05	Rebuild and test a Detroit Diesel fuel system	P	N	1	2	3	1	2	3	1	2	3
F	06	Rebuild and test a Roosa-Master fuel injection pump and injectors	P	N	1	2	3	1	2	3	1	2	3
F	07	Test and rebuild a Robert Bosch fuel injection system	P	N	1	2	3	1	2	3	1	2	3
F	08	Test and rebuild an American Bosch fuel injection system	P	N	1	2	3	1	2	3	1	2	3
F	09	Perform engine tests and adjustments of a live engine's fuel system	P	N	1	2	3	1	2	3	1	2	3
F	10	Test and repair a computer injection system	P	N	1	2	3	1	2	3	1	2	3
		REPAIRING POWER TRAINS											
G	01	Identify the components of a truck power train and explain their function	P	N	1	2	3	1	2	3	1	2	3
G	02	Overhaul a 10 speed transmission	P	N	1	2	3	1	2	3	1	2	3
G	03	Overhaul a 13 speed transmission	P	N	1	2	3	1	2	3	1	2	3
G	04	Overhaul an Allison automatic transmission	P	N	1	2	3	1	2	3	1	2	3

Duty	Task	REPAIRING POWER TRAINS - CONT.	P	N	Frequency			Importance			Difficulty		
					1	2	3	1	2	3	1	2	3
G	05	Overhaul and adjust a truck differential	P	N	1	2	3	1	2	3	1	2	3
G	06	Overhaul a truck power divider unit	P	N	1	2	3	1	2	3	1	2	3
G	07	Replace and adjust a truck clutch	P	N	1	2	3	1	2	3	1	2	3
G	08	Remove and install a transmission	P	N	1	2	3	1	2	3	1	2	3
G	09	Remove and install a differential	P	N	1	2	3	1	2	3	1	2	3
G	10	Replace a u-joint	P	N	1	2	3	1	2	3	1	2	3
G	11	Measure and adjust drive line angles	P	N	1	2	3	1	2	3	1	2	3
G	12	Lubricate chassis and perform preventive maintenance of power train components	P	N	1	2	3	1	2	3	1	2	3
G	13	Overhaul a five-speed transmission	P	N	1	2	3	1	2	3	1	2	3
G	14	Overhaul a two-speed differential	P	N	1	2	3	1	2	3	1	2	3
G	15	Overhaul a double reduction differential	P	N	1	2	3	1	2	3	1	2	3
		REPAIRING BRAKING SYSTEMS											
H	01	Identify an air brake system components and explain their function in the system	P	N	1	2	3	1	2	3	1	2	3
H	02	Replace brake shoes and linings	P	N	1	2	3	1	2	3	1	2	3
H	03	Replace a brake chamber diaphram	P	N	1	2	3	1	2	3	1	2	3
H	04	Troubleshoot and repair a live air brake system	P	N	1	2	3	1	2	3	1	2	3
H	05	Replace wheel bearings and seals	P	N	1	2	3	1	2	3	1	2	3
H	06	Locate and repair air leaks	P	N	1	2	3	1	2	3	1	2	3
H	07	Overhaul air compressors and air valves	P	N	1	2	3	1	2	3	1	2	3
H	08	Repair or replace unloader valves	P	N	1	2	3	1	2	3	1	2	3
H	09	Adjust air brakes and hydraulic	P	N	1	2	3	1	2	3	1	2	3
H	10	Identify hydraulic brake system components and explain their function	P	N	1	2	3	1	2	3	1	2	3
H	11	Repair engine brake problems	P	N	1	2	3	1	2	3	1	2	3

Duty	Task	REPAIRING BASIC HYDRAULIC SYSTEMS	P	N	Frequency			Importance			Difficulty		
					1	2	3	1	2	3	1	2	3
I	01	Identify various hydraulic system components and explain their function in the system	P	N	1	2	3	1	2	3	1	2	3
I	02	Test and diagnose various hydraulic system components for failure	P	N	1	2	3	1	2	3	1	2	3
I	03	Perform preventive maintenance and repairs to a basic hydraulic system	P	N	1	2	3	1	2	3	1	2	3
I	04	Explain the various laws of hydraulics and their application	P	N	1	2	3	1	2	3	1	2	3
I	05	Rebuild various hydraulic pumps, valves, and cylinders	P	N	1	2	3	1	2	3	1	2	3
		REPAIRING FRONT AXLES											
J	01	Remove and install springs and tie bolts	P	N	1	2	3	1	2	3	1	2	3
J	02	Replace tie rod ends, drag links, etc.	P	N	1	2	3	1	2	3	1	2	3
J	03	Replace king pins or ball joints	P	N	1	2	3	1	2	3	1	2	3
J	04	Overhaul power steering gears and pumps	P	N	1	2	3	1	2	3	1	2	3
J	05	Overhaul manual steering gears	P	N	1	2	3	1	2	3	1	2	3
		APPLYING PRINCIPLES OF RELATED INSTRUCTION AT JOB-ENTRY LEVEL											
K	01	Drive a truck on a road test	P	N	1	2	3	1	2	3	1	2	3
K	02	Use an arc welder in the shop	P	N	1	2	3	1	2	3	1	2	3
K	03	Use a cutting torch in the shop	P	N	1	2	3	1	2	3	1	2	3
K	04	Use an acetylene welder in the shop	P	N	1	2	3	1	2	3	1	2	3
K	05	Use basic math in a shop	P	N	1	2	3	1	2	3	1	2	3
K	06	Use business math (basic accounting) in a repair shop	P	N	1	2	3	1	2	3	1	2	3

Duty	Task	APPLYING PRINCIPLES OF RELATED INSTRUCTION - CONT.	P	N	Frequency			Importance			Difficulty		
					1	2	3	1	2	3	1	2	3
K	07	Spell words correctly	P	N	1	2	3	1	2	3	1	2	3
K	08	Prepare a job application	P	N	1	2	3	1	2	3	1	2	3
K	09	Write a resume	P	N	1	2	3	1	2	3	1	2	3
K	10	Write a work order	P	N	1	2	3	1	2	3	1	2	3
K	11	Develop good relations with customers	P	N	1	2	3	1	2	3	1	2	3
K	12	Explain basic electronics laws and principles	P	N	1	2	3	1	2	3	1	2	3
K	13	Explain torque multiplication	P	N	1	2	3	1	2	3	1	2	3
K	14	Explain hydraulic laws and principles	P	N	1	2	3	1	2	3	1	2	3
K	15	Perform shop management duties	P	N	1	2	3	1	2	3	1	2	3
K	16	Process warranty claims	P	N	1	2	3	1	2	3	1	2	3
K	17	Read shop blue prints	P	N	1	2	3	1	2	3	1	2	3

POLICE DEPARTMENT

TASK VERIFICATION FORM

Listed below are the tentatively identified tasks and duties for the Basic Recruit program at the Pinellas Police Academy. Please read each carefully and place a check mark (√) to the right of each task you feel should be included as a required task to be mastered by our graduates. Base your decision on how often the task is performed during a Recruit's first year on the job or how critical it is to a first year Recruit. Add any tasks you feel were omitted.

A. BASIC LAW

Advise persons of rights (per Miranda) ( )
Book suspects ( )
Classify incidents as criminal or civil ( )
File complaints ( )
Review arrest documents before accepting inmate ( )
Give depositions ( )
Testify at trials, hearings, or grand juries ( )
Serve as expert or expert witness in legal proceedings ( )
Establish case acceptance procedure or review case with state attorney ( )
Attend first appearance hearing ( )
Participate in pre-trial conference ( )
Consult legal advisor or prosecutor prior to any testimony ( )
Consult prosecutor on status of outstanding charges on prisoners' ( )
Participate in post-trial conference with prosecutor ( )
Prepare necessary information for obtaining or obtain arrest warrant ( )
Prepare necessary information for obtaining or obtain search warrant ( )
File complaints with the state attorney ( )
Execute arrest warrants or make return of warrant to proper authority ( )
Participate in execution of search warrants or make return of warrant to proper authority ( )
Supervise execution of warrant, capias profines, or subpoenas ( )
Review warrants assigned for correct information ( )
Verify out-of-country or out-of-state warrants before service ( )

ROANOKE-CHOWAN TECHNICAL COLLEGE
ROUTE 2 BOX 46-A
AHOSKIE, NORTH CAROLINA 27910

AIR CONDITIONING, HEATING & REFRIGERATION

TASK LISTING

Directions: Please evaluate the skills listed below according to the scale:

1. Essential for an entry-level position
2. Desirable for an entry-level position
3. Unnecessary for an entry-level position

Please circle the rating (1-2-3) which best describes the skills you feel should be performed during the first year in this occupation. Please do not omit any items.

In the space provided at the end of each section, please list and rate any additional skills that you feel are required to perform the job.

A. INSTALLING AND MAINTAINING HEATING SYSTEMS

		E D U
1.	Use tools, instruments, and materials to install an oil furnace	1 2 3
2.	Use tools, instruments, and materials to install a gas furnace	1 2 3
3.	Use tools, instruments, and materials to install an electric furnace	1 2 3
4.	Use tools, instruments, and materials to install a hydronic distribution system	1 2 3
5.	Replace oil burner controls	1 2 3
6.	Replace nozzles in oil furnace	1 2 3
7.	Replace ignition transformer	1 2 3
8.	Replace gas burner controls	1 2 3
9.	Clean and adjust gas burners and pilots	1 2 3
10.	Replace electric heat controls	1 2 3
11.	Replace electric heat elements	1 2 3
12.	Install electric baseboard heat	1 2 3
13.	Install blower motors	1 2 3
14.	Install and/or repair relays	1 2 3
15.	Install a thermostat	1 2 3
16.	Calculate loads for heating	1 2 3
17.	Adjust air handling components	1 2 3
18.	Change a pillow block bearing	1 2 3
19.	Determine feasibility of adding heating recovery system	1 2 3
20.	Clean/replace oil pump	1 2 3

SKILL VERIFICATION FORM FOR EMT'S

Name: Employed by:

Listed below are the tentatively identified skills for the emergency medical technology program at St. Petersburg Junior College. Please read each carefully and place a check mark (√) to the right of each skill that you feel should be included as a required skill to be mastered by the EMT upon completion of the course. Base your decision upon how often the task is performed in the field and how critical it is to the functioning of a basic EMT. Do not consider local protocol with ALS back-up. Add any tasks you feel were omitted. Thank you for your assistance.

A. Assessing Patients

1. Perform primary survey ( )
2. Measure and record vital signs ( )
3. Evaluate level of consciousness ( )
4. Check pupils ( )
5. Check skin color, temperature and moisture ( )
6. Examine environment ( )
7. Determine mechanism of injury ( )
8. Perform secondary survey ( )
9. Obtain patient history ( )
10. Perform CPR ( )

Comments:

B. Stabilizing Extremity Fractures

1. Assess neurovascular function ( )
2. Apply sling ( )
3. Apply sling and swathe ( )
4. Apply air-splint ( )
5. Apply traction splint ( )
6. Apply rigid splint ( )
7. Apply pillow splint ( )

Comments:

C. Controlling Bleeding

1. Apply direct pressure ( )
2. Apply pressure to pressure points ( )
3. Apply dressings and bandages ( )
4. Apply occlusive dressings ( )
5. Stabilize impaled objects ( )
6. Preserve and transport all avulsed or amputated parts ( )
7. Apply MAST ( )

Comments:

D. Providing Airway Care and Pulmonary Resuscitation

1. Open airway ( )
2. Check for breathing ( )
3. Maintain patient airway with airway adjuncts ( )
4. Assist ventilations ( )
5. Perform oropharyngeal suctioning ( )
6. Assemble oxygen equipment ( )

Comments:

E. Assisting with Childbirth

1. Determine stage of labor ( )
2. Prepare for delivery ( )
3. Assist mother in delivery ( )
4. Care for the neonate ( )
5. Control postpartum bleeding ( )
6. Administer emergency care in case of prolapsed cord ( )
7. Administer emergency care in case of breech birth ( )

Comments:

F. Moving Patients

1. Gain access to patients ( )
2. Immobilize spinal cord ( )
3. Remove patient to stretcher ( )
4. Carry loaded stretcher ( )
5. Transport patient ( )
6. Inspect vehicle and supplies after each run ( )

Comments:

G. Communicating/Reporting

1. Prepare patient care report form ( )
2. Relate patient information by two-way radio ( )
3. Report findings to hospital personnel ( )
4. Check supplies and equipment on vehicles daily ( )

Comments:

Major Categories in the Cognitive, Psychomotor and Affective Domains

The following resources were included in Module B-2 Develop Student Performance Objectives the Professional Teacher Education Module Series (PBTE). Instructors need to be certain the objectives they develop are appropriate (at the correct level).

MAJOR CATEGORIES IN THE COGNITIVE DOMAIN[1]

Evaluation
involves acts of decision-making, judgings, or selecting based on criteria and rationale

requires synthesis in order to evaluate

Synthesis
combines elements to form new entity from original one

requires analysis in order to synthesize

Analysis
separates whole into its parts, until relationship among elements is clear

requires ability to apply information in order to analyze

Application
uses information in a situation different from original learning context

requires comprehension of information in order to apply in new situation

Comprehension
interprets, translates, summarizes, or paraphrases given information

Knowledge
recognition and recall of facts and specifics

---

[1] Benjamin S. Bloom (Ed.), Taxomony of Educational Objectives, Handbook I: Cognitive Domain (New York, NY: David McKay Company, Inc.,1956).

MAJOR CATEGORIES IN THE PSYCHOMOTOR DOMAIN[2]

Naturalization
completes one or more skills with ease and becomes automatic with limited physical or mental exertion

Articulation
combines more than one skill in sequence with harmony and consistency

Precision
reproduces a skill with accuracy, proportion, and exactness; usually performed independent of original source

Manipulation
performs skill according to instruction rather than observation

Imitation
observes skill and attempts to repeat it

---

[2] R.H. Dave, as reported in Robert J. Armstrong et al., Developing and Writing Behavioral Objectives (Tuscon, AZ: Educational Innovators Press, 1970).

MAJOR CATEGORIES IN THE AFFECTIVE DOMAIN[3]

Characterizing
total behavior is
consistent with
values internalized

Organizing
committed to set of
values as displayed
by behavior

Valuing
displays behavior
consistent with
single belief or
attitude in
situations where he
is not forced to
comply or obey

Responding
complies to given
expectations by
attending or
reacting to stimuli
or phenomena; i.e.,
interests

Receiving
aware of;passively
attending to certain
phenomena and
stimuli; i.e.,
listening

---

[3] David R. Krathwohl, Benjamin S. Bloom, and Bertram B. Masia, Taxonomy of Educational Objectives, Handbook II: Affective Domain (New York, NY: David McKay Company, Inc., 1964)

Component C

Instructional Delivery in Competency-Based Education

Purpose

Four different topics are discussed in Component C including: task analysis, evaluation, student learning guides and CBE delivery in a traditional system.

The major emphasis of this component is directed to the design and development of student learning guides. Most instructors who have successfully implemented competency-based education use student learning guides as their primary means of instructional delivery.

Component C also includes information regarding implementation of CBE in a "traditional" or "conventional" classroom environment.

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Task Analysis

C-1

Component B of the Resource Guide helped us to identify and validate competencies (tasks). A procedure was outlined for developing a list of tasks, having business and industry verify these tasks as necessary for entry level employment and then producing an official program task listing.

It is absolutely mandatory that a validated task listing be developed before any further CBE implementation activities take place.

Remember, our definition of competency-based education includes only three essential elements and one of them is: all training is organized around and based on precise industry validated statements of student outcomes which clearly describe what the student will be able to do as a result of training. Make sure a validated task listing is available before proceeding with any additional CBE development activities.

What is Task Analysis?

The goal of the task verification process was to analyze an occupation and break it down into tasks. The goal of task analysis (sometimes called task detailing) is to analyze a specific task and break this task down into steps.

Task analysis is the process of identifying the skills, knowledge and attitudes necessary to demonstrate competency of a specific task.

In other words, what are the steps a student must be able to do (or know) to successfully perform a task?

The following graphic illustrates the importance of task analysis to the teaching/learning process. Once a task is "broken down" into steps; it is much easier to develop instructional materials and evaluation instruments (tests).

WHY TASK ANALYSIS?	
Identify	**Explanation**
Steps (Skill, Knowledge)	Each step is identified and written down so that instructors can be certain that learning activities cover all essential steps in performing the task. Later, this will help us to develop valid and reliable tests. Steps and procedures that are second nature to an instructor are often unfamiliar to students. Task analysis requires us to list all essential steps. Suggestion: Include only essential steps (skill, knowledge) and not "nice to know" items. Keep the level of your students in mind when deciding how much detail to include. Teach technical knowledge right along with the task when this technical knowledge is needed. Do not artificially separate knowledge into "theory" courses. Observe a competent worker perform the task to assure no essential steps are left out.
Tools and Equipment	List any special tools or equipment that are necessary for successful performance of a task. Have students learn how to use special tools when they are learning the specific task these tools will be used for. Do not list routine tools or equipment (i.e. hammer, screwdriver, etc.) students already know how to use. In CBE students should learn how to use tools and equipment when they are needed.

Identify	Explanation
Related Knowledge	List information (related knowledge) needed by a student to perform a task but not necessarily related directly to the steps in performing the task such as math, science, physics, etc. Teach related knowledge right along with the task since students seem to learn better and have a more positive attitude when they can see a relationship of what they are learning is necessary to successfully perform a task. Include only essential related knowledge and not "nice to know" facts.
Safety	List any safety knowledge or practices that are necessary for safe performance of the task. This assures specialized safety practices will be taught when they are needed. Do not list general safety practices that the student is already aware of but only those that are relevant to the specific task.
Attitudes	Identify attitudes that are critical for performing the task. List only attitudes that are essential for performance of the task.

Several formats have been developed to assist instructors in analyzing tasks. The next page contains a sample of a task analysis form that has been successfully used by CBE educators. This sample lists the steps that an instructor would go through in analyzing the task "Install bridging between joists". A blank copy of this form is included in Component E of the Resource Guide. Please review the sample task analysis form on the next page. Samples of additional task analysis information are also included in the resource section of this component.

TASK ANALYSIS FORM

TASK:	Install bridging between joists

Procedural Steps & Technical Knowledge

List each procedural step & technical knowledge required to perform task from start to finish on the job.

1. Determine number of bridging pieces needed (2 for each opening).
2. Determine miter angle for ends of bridging, either by scribing or by drawing rectangle of specified dimensions and measuring diagonal.
3. Layout and cut bridging.
4. Start 2 6d nails in each end of bridging at such an angle that when driven, they come through thick part of miter cut.
5. Determine location of bridging by dividing span into equal parts 6-8 feet apart; make pencil marks at those points.
6. Snap chalk line across top of joists between pencil marks.
7. Nail one end of bridging to side of joists approx: 1/4" from top and to one side of chalk line.
8. Nail another piece in the same opening but on the side of the next joist approx. 1/4" from top and on opposite side of chalk line.
9. Repeat this procedure in all of the openings, nailing only the tops.

10 Nail bottoms of bridging from underneath after subfloor is completed and nailed down.

Tools	List special tools, equipment, materials, etc. needed to perform this task:	None
Related	Related math, science or background knowledge needed to perform this task competency:	1. Basic geometry to determine angle or cut on bridging ends. 1. Proper use of hammer, chalk line, and portable power saw. 3. How to read and measure with rule.
Safety	List critical safety knowledge and skills needed to perform task in a safe manner:	1. Make sure that joists are nailed solidly in place before walking on them.
Attitudes	List attitudes critical to performing task in a competent manner on the job:	1. Use caution but don't be timid when walking on joists.

All Skills and Knowledge Should Be Directly Related to the Task

Remember in competency-based education students should learn the technical knowledge, specific related skills, safety practices, use of specialized equipment and tools, and critical attitudes while they are learning the actual "hands on" skills necessary to demonstrate competency in a task. Students seem to learn facts, theory and other related subjects when they can see a direct relationship of these concepts. If students can directly apply what they are learning they are often more motivated causing a decrease in absenteeism, tardiness and attrition.

Evaluation of Competencies

What is the Next Step?

At this point in the CBE development process we have identified competencies and formulated an official program task listing. These tasks have also been translated into performance objectives and "broken down" into steps by task analysis. Many instructors would consider the next logical step in the process would be to develop instruction and instructional materials (learning guides, lesson plans, syllabi, etc.). Wrong! In CBE test (evaluation) development is done before instruction is designed. CBE requires that instructors develop tests before even considering how a task will be taught. This concept might seem strange to many instructors who are used to teaching in a traditional or conventional delivery system. These instructors might question the logic of this process (developing tests before designing instruction) because, how can one determine what to test unless one knows what a student has been taught. This fact emphasizes one of the major differences between competency-based education and traditional education. Remember, in Component A of the Resource Guide we discussed that CBE was based on validated tasks (fixed content) and that traditional education was often based on the contents of a book or other resource. In CBE we are evaluating whether or not a student can demonstrate mastery of a specific task. Mastery is defined as a level of acceptability which indicates a student can perform competently at the job entry level within a particular occupation. In the more traditional delivery system we are often evaluating if a student can "pass" a test based on the contents of a resource which may or may not be correlated to an industry validated task. In CBE we evaluate performance of tasks as they should be performed on the job, not as they were "covered" in a particular resource. If tests are developed before instruction then instructors know exactly what students have to learn and are more inclined to select appropriate resources. Several learning options can also be formulated if instructors are not at the "mercy" of one resource.

Throughout the Resource Guide we have emphasized the three major elements of competency-based education. Once again they are:

√ base instruction on industry validated competencies

√ deliver instruction with the individual learner foremost in mind,

√ evaluate students based on their ability to perform the skill in question.

Basic Goal

This section of Component C focuses on the third major element of CBE:

EVALUATION

The basic goal of competency-based education is to have students learn skills, knowledge and attitudes at a level which will enable them to perform successfully on the job. Therefore it is critical that we have an evaluation process to measure successful performance. How can we say a student is "competent" unless we have an objective method of evaluation. With this fact in mind, a competency-based program can only be as good as its evaluation instruments (tests). If we as vocational technical educators are telling employers that our graduates are "competent" we need to be prepared to back up that claim. Testing allows us to tell whether or not a student can demonstrate mastery.

There is a basic difference in evaluation (testing) in a competency-based education program and a traditional or conventional one. The graphic on the next page illustrates some of the philosophical differences.

TESTING

Competency-Based Evaluation	Traditional Evaluation
Testing is criterion based, a student's performance is compared to a pre-set fixed standard.	Testing is often "norm" based, a student's performance is compared to the performance of other students in the class. Students' grades are often scaled or weighted with a few "A"s, a few "F"s and mostly "C"s.
Each student is required to perform each task at a high level of proficiency before receiving credit or moving on to the next task. Mastery of the task is required.	Students are often allowed (or even forced) to move on to the next unit after only marginally mastering or even failing (grades are averaged) the present unit of instruction. A grade of 70% is necessary to pass.
Students are required to perform each task in a job-like setting. Students are tested on an individual basis when they are ready to demonstrate mastery.	Evaluation in the traditional system places a heavy reliance on paper and pencil tests. Students are tested in groups at predetermined times (midterms, finals, etc.)
Students know exactly what they will be expected to do and how they will be evaluated.	Students often have little or no idea how they will be evaluated. Unimportant facts and theory are often emphasized. Testing can become a guessing game.

Why Test?

The preceding graphic illustrated differences between testing in a competency-based environment and a traditional delivery system. The major difference is in competency-based education each task is tested for mastery and a student is not given credit for a task until he or she can demonstrate mastery as determined by a performance and/or written test.

Mastery

The Major Reason for Testing in CBE is to Determine Whether or Not a Student Has Demonstrated Mastery in a Specific Task.

Although the major reason for testing in competency-based education is the assessment of mastery of a task, there are also several other functions testing provides including:

Articulation

Often students already possess some of the skills or knowledge included in a training program either through previous experience or learning. Students can be given credit for a complete course or units of a course based on their ability to demonstrate mastery. It is a waste of the student's time to be taught skills he or she has already learned. Testing allows us to grant credit based on the actual ability of a student to perform.

Diagnosis

Tests can be used to diagnose specific weaknesses (or strengths) of students, especially students new to the training program. If an instructor can identify areas of weakness then a remediation plan is easier to develop.

Feedback

Immediate and continuous feedback regarding progress is available to students when effective tests are developed. CBE uses informal tests called self checks to assure feedback. (Self checks are discussed in the next section of this component)

Evaluation of Training Materials

Testing can be used to measure the effectiveness of the instruction and instructional resources used in the training program. If a high percentage of students are having trouble demonstrating competency for a specific task something might be wrong with the learning activities and or resources.

Two Categories of Testing

There are two categories of testing in competency-based education, **informal** tests and **formal** tests. Informal tests evaluate a student's performance of steps. Informal test scores are not normally recorded in a grade book and are not calculated into the student's grade for the course. The major function of informal tests is to provide feedback to students as they go through the steps necessary to learn a task. **Informal testing lets a student know whether he or she is ready to go on to the next step involved in learning a task.** Several examples of informal tests are included in the sample learning guides contained in the resource section of this component. The other category of testing in competency-based education is formal tests. **Formal tests are the evaluation instruments used to determine whether or not a student can demonstrate mastery of a specific task.** When a student has completed all the activities involved in learning a task, he or she is then given a formal test which will determine mastery. Results from this test are part of the student's permanent record (assuming the student has successfully demonstrated mastery).

Two Types of Tests

There are basically two kinds of formal evaluation instruments (tests) used in competency-based education. They are written tests and performance tests. Written tests are used to test knowledge (cognitive) and performance tests are used to evaluate performance skills ("hands on" skills). Both written and performance tests will be discussed in detail in this section.

All tests in competency-based education should be reliable, valid, objective and comprehensive. All four factors are interelated. Definitions of these four factors are:

Reliability

A test is said to be reliable if it yields consistent results when it is used. In other words, students who can perform a task at mastery level will pass and those who cannot will fail.

Validity

A test is said to be valid if it measures what it is supposed to measure. A written test would be invalid for measuring psychomotor skills.

Objectivity

A test is objective when no bias and/ or the instructor's personal opinions are involved in grading the results of a student's performance. Any instructor (assuming he/she is qualified as a content expert) would obtain the same results in evaluating a student's work.

Comprehensive

A test is comprehensive if it measures all essential behaviors (knowledge, skill, affective) as stated in the task. In other words, is there enough criteria in the test to assure that a student has actually mastered a specific task.

Task Oriented

Remember, competency-based education is task oriented. There is usually only one formal test for each task. Sometimes a student will be required to take two tests (written and performance) when mastery requires both performance and knowledge (facts, theory, concepts, principles and other related knowledge items that are essential to performing the skill).

In competency-based education most tests will be performance tests. Remember, most of the tasks on a program's official task listing should be based on "hands-on" skills. If a task requires a student to do something then the test should require the student to do it and not write about how to do it. Written tests should be used if appropriate and not for the convenience of the instructor. Use written tests only if your goal (as specified by the task) is to evaluate a student's mastery of knowledge related items such as facts, theory, and principles. An instructor should ask the following question to determine what type of test (written or performance) should be used to determine mastery.

WHICH TYPE OF TESTING SITUATION REQUIRES THE STUDENT TO PERFORM THE TASK AS IT SHOULD BE PERFORMED ON THE JOB IN A REAL WORK SITUATION?

Make Sure the Test Matches the Task

The following example illustrates the concept of having tests match tasks. In this example a cosmetology instructor is in the process of developing a test to assess mastery of the task "Apply a permanent hair color". Below are some possible testing situations that the instructor might consider.

√ 1. Have the student perform this service on a mannequin.

√ 2. Have the student explain from memory the step-by-step procedure for applying hair color.

√ 3. Require the student to apply permanent hair color on a client.

√ 4. Require the student to pass a comprehensive written examination covering the chemical composition of hair and hair dyes, appropriate sanitary procedures and the correct procedure for applying permanent hair coloring.

It is fairly obvious that there is only one logical testing situation in the above four examples. Remember, the test should match the task by requiring the student to perform the task as it should be performed on the job. Testing situation #3 (Require the student to apply a permanent hair color on a client) is the only logical choice to test the task "Apply a permanent hair color".

Once again, the purpose of testing is to determine whether or not the student can perform a skill to meet a predetermined level of acceptability (mastery). In order for an instructor to determine mastery (predetermined level of acceptability) the student's performance and/or the product of his/her performance must be evaluated. The student's performance (sometimes called the process) is how the student performs the task. The product is the end result of the performance.

Process/Product

Process evaluation measures the student's ability to correctly perform steps involved in completing a task. Product evaluation measures desirable characteristics of a finished product. Most competency-based education programs use a checklist to evaluate a student's performance/product skills. Please review the checklists on the next several pages.

TASK: Perform Oxyacetylene Welding

STUDENT'S NAME ____________________ **DATE** ____________

DIRECTIONS TO STUDENTS:

You will be given oxygen and acetylene and a regulator for each appropriate cylinder. You must follow all approved safety steps when setting up, shutting down, troubleshooting your OAW station. Light your torch and explain the three major flames produced. On the plate provided, you must produce two acceptable stringer beads, one without filler metal and one with. Next you must do an acceptable fillet lap joint in the horizontal position and properly shut down the torches.

Students must score 100% for mastery being allowed to proceed on.

ITEMS TO BE EVALUATED:	YES	NO
1. Checked to make sure cylinders were in vertical position and secured in place.		
2. Cracked valve of each cylinder and check all connections to insure they were clean from dirt, oil, etc.		
3. Connect oxygen regulator to oxygen cylinder a. Turned adjusting screw on regulator counterclockwise. b. Slowly opened cylinder valve, then opened completely.		
4. Connect acetylene regulator to acetylene cylinder a. Turned adjusting screw on regulator counterclockwise. b. Slowly opened cylinder, then 1/4 to 1/2 turn maximum		
5. Connect hoses to regulators?		
6. Check for leaks in system using Ivory Soap Solution?		
7. Pointed torch away from people or combustible material when preparing to light?		
8. Weld Stringer Bead on Flat Plate without Fill Material?		
9. Weld Stringer Bead on Flat Plate with Filler Metal?		
10. Weld Fillet Lap Joint Horizontal Position?		
11. Bled all lines and turned off cylinder valve?		
12. Backed off regulator thumb screw before leaving station?		

PERFORMANCE TEST DUTY: D TASK: 4

PERFORMANCE OBJECTIVE:

GIVEN: A Cummins diesel engine and special tools.

YOU WILL: Time the Cummins engine.

HOW WELL: According to criteria as stated in the Performance Test.

ALL ITEMS MUST BE MARKED "YES" FOR ATTAINMENT.

	YES	NO
1. Was the timing tool installed in the engine correctly?	______	______
2. Were the gauges set up correctly?	______	______
3. Was the engine rotated in the correct rotation for TDC?	______	______
4. Was the gauge for TCD set on zero?	______	______
5. Was the engine rotated to 90° in the correct rotation?	______	______
6. Was the gauge over the push rod set on zero?	______	______
7. Was the engine rotated in the correct rotation to 45° before TDC?	______	______
8. Was the engine rotated to .2032 BTDC correctly?	______	______
9. Was the reading on the push rod guage correct?	______	______
10. Was the work station cleaned?	______	______

Task: Give a hair cut using a razor to style patron's hair

Achievement Indicators: The learner:	Yes	No
1. Practiced holding and manipulating razor	______	______
2. Assembled materials	______	______
3. Sanitized hands	______	______
4. Prepared patron for service	______	______
5. Shampooed or wet the hair	______	______
6. Sectioned hair	______	______
7. Checked position of guard on the razor	______	______
8. Determined the length to cut nape guideline	______	______
9. Held razor and comb correctly	______	______
10. Shaped guideline holding razor flat on hair strand by:	______	______
a. Cutting hair on left side in toward center nape		
b. Cutting hair on right side to match left side		
11. Checked the length of guideline on each side for evenness	______	______
12. Shaped remaining sections according to guideline	______	______
13. Checked finished hair cut for balance	______	______
14. Removed cut hair from cape	______	______
15. Removed cape from patron	______	______
16. Cleaned and sanitized implements and area	______	______

Checklist Functions

The checklists you reviewed have two basic functions.

1. Students know exactly how they will be evaluated on their performance of a task because specific items are included on the checklist.

2. All students are evaluated by the same standards. The checklist serves as a guide for instructors to evaluate mastery. There is no confusion for the student or teacher as to what mastery of a specific task is.

What Type of Checklist Should Be Used?	
Performance (Process)	If it is necessary for an instructor to observe certain steps performed by the student while the student is in the process of performing the task then a performance (process) checklist should be used.
Product	If an instructor can evaluate mastery by examining the final product of a task and does not have to observe the actual process then a product checklist can be used.
Performance/ Product	If an instructor must examine both the process of how a task is performed and the final product of a performance a combination of performance and product items should be included on the checklist.

How to Design a Performance Test Checklist

The following information describes the procedure and sequence of designing a performance checklist.

1. Identify the task you are testing. It is helpful if the task is even more specific and developed into a performance objective.

Task-

Take and record oral temperature

Performance Objective-

Given a patient and thermometers, select the correct thermometer and take and record the patient's temperature with 100% accuracy on the performance test.

2. Determine whether a product, performance or both are critical for evaluation of mastery.

The task "Take and record oral temperature" requires both a process and product checklist. The instructor must observe the student go through a series of steps while taking a patient's temperature (process/performance) to arrive at the correct temperature reading (product). Remember, the major reason for testing in CBE is to determine whether or not a student has demonstrated competency in a specific task. With this fact in mind, list only essential performance and or process items on a checklist. The instructor considered the following thirteen processes and product items listed on the next page essential for determining mastery.

Items on the performance test for the task "Take and Record Oral Temperature" might include:

1.	Washed hands?
2.	Selected correct thermometer?
3.	Checked level of mercury in the thermometer?
4.	Shook mercury level to 95°F, if necessary?
5.	Identified patient and explained procedure?
6.	Correctly placed thermometer in patient's mouth?
7.	Instructed patient to close mouth and not talk?
8.	Left thermometer in place for 3-5 minutes?
9.	Removed thermometer, wiped with a clean sponge or removed sheaf?
10.	Read thermometer correctly (within 1/10 degree of instructor's reading)?
11.	Shook thermometer down and placed in proper location for cleaning?
12.	Recorded reading correctly?
13.	Washed hands?

Notice that 11 of the 13 items on the checklist referred to how the student performed the task. Only items #10 and #12 were directed at the product. Select only those process and performance items that are essential.

Suggestions for Process/ Performance Checklist Items

1. List all critical steps (in sequential order) as identified in the task analysis.

2. Each item should include only one step and be clear, concise and independent of the other items.

3. Each item should be observable, measurable and objective.

4. Anyone with content expertise in the task should be able to evaluate a student using the items on the performance test.

5. Each item should be worded clearly and simply to avoid subjective evaluation.

6. List critical "checkpoints" next to an item if necessary. Checkpoints tell the student to stop and make sure the instructor evaluates his/her performance (i.e. "check with instructor before installing valve cover") in instances where work could be "hidden" or danger might be involved if the step is not performed correctly.

Suggestions for Product Checklist Items

1. List only essential characteristics of the finished product (characteristics that would distinguish between competence and non-competence).

2. Items should be clear, concise and independent of each other.

3. Each item should include exact specifications of acceptability (i.e.± .002 inch, contain no errors, 60 w.p.m., etc.).

4. Use job entry level standards.

3. Determine how items on a checklist will be rated. The most common rating system used for rating items on a performance checklist is to rate each test item yes or no (i.e. pass/fail, acceptable/unacceptable, satisfactory/unsatisfactory, etc.).

4. Determine the score necessary for mastery.

High Level of Mastery

The authors of this resource guide recommend that the minimum score for mastery be 100%. All of the items (performance/product) should be checked "yes" on the performance checklist for a student to be considered competent. This concept (mastery score of 100%) is often difficult to understand for instructors who are used to teaching in a conventional system. They equate the score of 100% to perfection or extremely outstanding work. A score of 100% on a performance test indicates mastery at job entry level specifications and not necessarily perfection. Remember if you have designed your checklist items correctly and have included only essential process and product items a student should score 100% to demonstrate mastery. If a student "misses" one item that means he or she has not done something that is essential to performing the task. A score of 100% on a performance test cannot and should not be equated to a grade of "A" in a traditional grading system. (Grading will be discussed in Component D of the Resource Guide.) When a student receives a score of 100% on a performance test we are not saying that student is perfect, but we are stating that he or she has demonstrated mastery of a specific task by successfully completing all the essential steps. (If only one or two items are missed on a performance test the student may not have to repeat the entire test. The problem can often be corrected as it occurs.)

Why 100%

Advocates of a 100% mastery score use the following example to reinforce their belief.

Example: "Take a picture with a 35mm rangefinder camera". The minimum score for mastery is 90%; each item is worth 10 points.

	Yes	No
1. Was the proper film selected	x	
2. Was film properly loaded	x	
3. Was camera set to correct ASA	x	
4. Was shutter speed set for subject	x	
5. Was exposure correct	x	
6. Was subject in focus	x	
7. Was lens cap removed		x
8. Was camera held correctly	x	
9. Was correct lens used	x	
10. Was film removed from camera	x	

The above example illustrates the point that a 90% score does not always indicate competency. Missing only one item on the checklist (#7) results in a blank roll of film, hardly the indication of a "competent" photographer.

5. Write directions for taking the test. Directions should inform the student of the task to be evaluated, any time limits or other conditions that will be imposed. Directions should be clear and inform the student exactly what is expected and how mastery will be determined. (Examples of test directions are included in the student learning guides contained in the resource section of this component.)

6. Evaluate the test and revise if necessary. Have another instructor with content expertise in the specific task review the test. Try the test out with a few students. Make any revisions that might be required.

Developing Written Tests

Written tests are used to evaluate a student's mastery of knowledge tasks or to assess mastery of cognitive skills that are essential for performing a task correctly. Traditionally, written tests have been overused in vocational technical education. Written tests are a valuable instrument to assess mastery when they are appropriate. Do not use them to measure performance of "hands on" psychomotor skills. If a task requires a student to do something, have the student do it.

Basically there are six different types of written tests:

Short Answer
Completion
Essay
Multiple Choice
True-False
Matching

Information on the following page (adapted from How to Evaluate Students in a CBVE Program. 1978, Maryland Department of Education, Division of Vocational Education) describes the advantages and disadvantages of each type of written test.

Advantages and Limitations of Writtem Test Items

Type of Test Item	Advantages	Limitations
1. Multiple-Choice	1. Subjective scoring is eliminated. 2. Guessing is reduced. 3. This type is versatile-can be used to measure recall of knowledge or application of principles.	1. Good items are difficult to write. 2. Good options are sometimes hard to find. 3. This type requires longer student response time than do true-false items.
2. True-False	1. Test items can cover a large content area in a brief amount of student time. 2. Subjective scoring is eliminated. 3. This type provides a realistic task for many students, since they are often asked to judge the truth of a statement in real life.	1. Student guessing is encouraged. 2. This type is often misused to test unimportant or highly specific information. 3. This type is fairly limited to recall of information. 4. Good, unambiguous items are difficult to construct.
3. Matching	1. Much factual information can be tested in a realtively short time. 2. Subjective scoring is eliminated. 3. This type is useful in assessing student's ability to match words with definitions, events with places, concepts with words or symbols, etc.	1. A good set of matching items is sometimes difficult to develop.
4. Completion	1. The possibility of a student's guessing the correct response is reduced. 2. This type is relatively easy to construct.	1. This type often cannot be scored as objectively as can multiple-choice, true-false, or matching. 2. This type is useful for testing recall of information, rather than application of principles in new situations.
5. Short Answer 6. Essay	1. These are relatively easy to construct. 2. More complex types of achievement can be measured. 3. Emphasis can be placed on larger units of instruction. 4. The student is required to generate an original response. 5. The possibility of a student's guessing the correct answer is reduced.	1. These are time-consuming to score. 2. The areas to be tested are limited, since more time is required for student response. 3. It is difficult to score these objectives. 4. The student's ability to communicate in writing can be confused with his or her ability to answer the question.

What Type of Written Test Should Be Used?

All six different types of written tests described on the preceding page are appropriate for assessing knowledge. The authors of this publication strongly recommend the use of multiple choice tests for the following reasons:

Why Use Multiple Choice Tests?	
Objective	Little room for subjectivity or instructor bias since only one response is correct.
Test Different Levels of Knowledge	Multiple choice tests can be used to assess different levels of knowledge (knowledge, comprehension, application, analysis, synthesis, evaluation)
Low Guessing	Unlike true/false tests multiple choice tests can have a low guessing factor if correctly designed.
Easy to Score	Multiple choice tests are easy to score and can be scored quickly with no scoring errors.
Easy for Students to Take	Most students are familiar with multiple choice tests.

Developing Multiple Choice Tests

A multiple choice test consists of two parts: a stem and alternatives.

Stem-

WHAT TYPE OF PIPE SHOULD BE USED FOR NATURAL GAS LINES?

Alternatives-

A. Steel
B. Galvanized
C. Black Iron
D. Aluminum
E. Copper

STEM-

The stem can be a question, a statement or a phrase.

Guidelines for Developing Stems

1. Avoid the use of negative expressions in the stem since this often causes confusion.

2. Do not end the stem with "a" or "an". If a stem ended with "an" a student could eliminate all the alternatives that begin with a consonant.

3. Use vocabulary in the stem that matches the average student's reading level.

4. Use correct grammar and punctuation in the stem.

5. The stem should be clear and should not be vague.

6. Do not include clues in the stem which could possibly give away the answer.

7. It is appropriate to refer to schematic, diagrams, math problems in the stem.

Guidelines for Developing Alternatives

1. All alternatives should be reasonable answers to a student who does not know the correct answer.

2. Be sure there is only one correct or best answer.

3. Avoid the use of negatives.

4. There should be no fewer than three alternatives and no more than five.

5. There should be no pattern of correct answers.

6. Be careful when using "all of the above" or "none of the above".

7. All alternatives should appear on a separate line.

Guidelines for Written Tests

Regardless of what type of written test you use to evaluate cognitive knowledge make sure that items on the test are essential to the successful performance of the task. With this fact in mind aim for a mastery score of 100%. If you decide to have a mastery score that is lower than 100%, you in fact are stating that some of the items included on the test are not essential for mastery. Remember, the primary function of testing in competency-based education is to assess whether or not a student has mastered a task.

(The term written test is used as a matter of convenience to distinguish tests that measure cognitive skills from performance tests that measure performance skills. Oral tests can be considered written tests if they measure cognitive skills. Oral tests should be used when appropriate.)

Examples of both written and performance tests are included in the student learning guides contained in the resource section of this component.

Developing Student Learning Guides

C-4

Up to this point, in the Resource Guide we have discussed only two of the three essential elements of competency-based education:

- **base instruction on industry validated competencies,**
- **evaluate students based on their ability to actually perform the skill in question.**

Now, we are going to discuss the actual delivery of instruction. Most schools that have successfully adopted CBE use student learning guides to deliver instruction for each task. A student learning guide is simply a set of detailed instructions that guides students through the learning process. Learning guides serve as "roadmaps" that direct the student through a variety of activities. Field testing and quality assurance of learning guides will be discussed in Component D of the Resource Guide.

Why Learning Guides

Now, let's examine why the use of packaged instruction, called student learning guides, is so essential to competency-based education. Let's look at a few facts:

1. The instructor in a technical-vocational program can only be at one place at one time and can, therefore, only teach one task at a time.

2. If mastery learning is to take place, learning time should be flexible so each student can spend as much (within reason) or as little time on each task to reach the desired level of mastery.

3. Students have vastly different reading and comprehension backgrounds, interests, and maturity. They often have optimum learning rates that differ substantially from one another. This learning rate can often change depending on the task to be learned, the time of year, and a host of other factors.

4. If we are going to let time be flexible and if students do differ in their learning rates-even if all students begin a program on the same day; they would soon be working on different tasks at any given time. If on a given day, twenty students have been allowed to spread themselves out over 12 different tasks, the instructor can only teach one task at a time. Something else must teach the other 11, at least temporarily, until the instructor can get around to everyone.

5. Another reason for the use of learning guides is the possibility of flexible entry. Students can enroll in programs at different times during the year. It would be difficult if not impossible to conduct traditional structured lecture classes with flexible enrollment.

The "something other than the instructor" translates into learning guides. Hopefully one can see that the use of some form of "packaged " instruction is not an option but is a requirement if we want to provide high quality instruction and sufficient time to learn.

Why Use Learning Guides

The following four paragraphs illustrate why learning guides are an effective resource.

1. The pace of instruction can be controlled by the student, not the instructor. When giving a lecture, the instructor can only guess at what the best delivery rate should be. Whatever rate is followed, it is often too fast for some and too slow for others. When the instructor controls the pace of instruction it is almost like someone else is turning the pages of a book for you. Sometimes it will be too soon and you will miss some of what was on a page; sometimes it will be too slow and you will become bored or distracted. Learning packages allow the student to decide when to turn the page, when to advance the filmstrip, when to attempt the practice.

2. Instruction can be stopped and restarted or repeated if necessary to learn efficiently. With learning packages the student can stop at almost any point along the way and begin again in a few minutes, tomorrow or on Monday and pick-up exactly where he or she left off without missing anything in between. Another plus is the ability to repeat instruction as often as needed to learn. This is difficult or impossible in the group oriented approach. If a student failed to understand or was absent (physically or mentally) during a key portion of a lecture, chances are the group will move right on to the next topic. When instruction is captured on printed pages, in drawings, diagrams, videotapes, slides etc., a student can repeat all or part of it twice, three times or how often needed to learn.

3. Students can spend most of their day actively engaged in learning. Many studies show that over one-fourth of the day in group instructional settings is wasted just getting the class settled, getting students started on their work and keeping the group under control. Studies show when students have learning packages they spend the majority of the day working rather than waiting for the lecture to begin, attendance to be taken, or waiting for some students to sit still and be quiet so class can continue.

4. Learning materials are available when and where needed. If instruction is packaged and mediated and stored in locations easily accessible to students, instruction in each task is theoretically available 24 hours a day, 7 days a week, all year long. A student doesn't have to miss out. A student enrolling a month after school starts doesn't have to catch up to the rest of the group. Materials can be used during the day, the evening and can even be taken home. They are available for use in the classroom, the shop, the lab, the library, or at a remote site.

Delivering instruction by learning guides is no different than delivering instruction by lectures and demonstrations in terms of the need for quality. A poorly developed learning guide is just as bad (actually worse) than a poorly prepared and delivered demonstration or lecture. Learning guides will only be effective when they have been developed in a quality manner. This section of the Resource Guide will walk you step-by-step through the process of putting together high quality learning guides. A discussion of quality control of learning guides is also included in Component D of the Resource Guide.

Relationship Between Tasks and Learning Guides

Keep in mind that in the competency-based system of learning there will be one learning guide for each task on the program's task listing. If your program has 82 tasks on its task listing, your program should have 82 separate learning guides. Each guide will teach one distinct task. On the next page is a sample page from a task listing from the Mechanical Electrical Technology program at TSTI-Amarillo. The sample learning guide you are about to review is based on Task E01 from this task listing. It is mandatory that you have a well developed task listing before proceeding to develop learning guides. Development of a task listing was already covered in Component B of the Resource Guide.

TASK LISTING

PROGRAM:

Task No.	Std. Hrs.	
13	4	Troubleshoot fuel system
14	7	Troubleshoot and maintain fire-side of fire-tube boilers
DUTY E	120	MAINTAINING REFRIGERATION SYSTEMS
01	20	Fabricate tubing
02	20	Solder refrigeration tubing
03	20	Trace refrigeration cycle
04	8	Determine pressure temperature relationships
05	12	Evacuate and charge a refrigeration system
06	6	Disassemble and reassemble a semi-hermetic compressor
07	5	Analyze refrigeration system components
08	29	Troubleshoot refrigeration electrical system
DUTY F	120	MAINTAINING PNEUMATIC CONTROL SYSTEMS
01	10	Analyze pneumatic control fundamentals
02	6	Calibrate pneumatic control devices
03	6	Calibrate pneumatic thermostats
04	6	Calibrate pneumatic humidistat
05	8	Calibrate dual temperature thermostats
06	8	Calibrate receiver-controllers
07	8	Calibrate differential pressure controller
08	8	Maintain air compressor system
09	10	Calibrate chart and strip recorders
10	10	Calibrate process controllers
11	20	Analyze square root extractors, integrators, and flow transmitters
12	10	Calibrate pressure transmitters
13	10	Calibrate differential pressure transmitter
DUTY G	170	MAINTAINING MECHANICAL SYSTEMS
01	10	Analyze the fundamental requirements for a scheduled maintenance program
02	4	Troubleshoot gears
Total Tasks	Total Std. Hrs	REVISED:

As students proceed in a training program, they will work their way through the learning guide developed for each task. Providing your students with a copy of your program's task listings will in effect be giving them a list of all the learning guides in your program.

Keep in mind, however, that just because the tasks are listed on your task listing in a particular sequence does not necessarily mean that students should go through your learning guides in that same sequence. In many instances, students may be able to jump around and complete learning guides from different parts of the task listing (depending on prerequisites). Task sequencing is discussed in Component D of the Resource Guide.

A Sample Learning Guide

On the following pages is a sample learning guide* following a format developed at TSTI-Amarillo. Go through this sample guide very carefully from beginning to end. In most cases the learning guides you develop will not be as lengthy as this sample. This sample was included because it uses a variety of resources and requires the student to demonstrate competency by both performance and knowledge testing. Another reason this learning guide was included as a sample is that it has been used over a period of time and has proven very effective; students can fabricate tubing at a high level of mastery after completing the learning guide. The average learning guide used in CBE programs is approximately 15 pages in length. Additional samples of learning guides are included in the resource section of Component C. Each individual section of the learning guide will be discussed later in this section.

* This learning guide was developed by Paul Ackerman, Program Chairman of Mechanical Electrical Technology, TSTI-Amarillo.

TSTI AMARILLO

STUDENT LEARNING GUIDE

PROGRAM: Mechanical Electrical Technology

DUTY: E Maintaining Refrigeration Systems

TASK: 0 1 Fabricate tubing

INTRODUCTION:

The fabrication of tubing is an important aspect of maintenance on mechanical and refrigeration equipment. The proper technique of tubing fabrication will result in equipment which performs more effeciently, looks better, and is more reliable in getting its job accomplished. Refrigeration and air conditioning work requires you to know the types of tubing, fittings, and the assembly procedures available to make necessary repairs.

The mechanical electrical technician must be an expert in bending and joining tubing since even the smallest of leaks cannot be tolerated. Kinks in tubing result in decreased flow along with increased friction loss and horsepower requirements which greatly decrease a system's performance.

PLEASE DO NOT WRITE IN GUIDE.

OBJECTIVES

PERFORMANCE OBJECTIVE:

(Include condition, performance, and standard)

GIVEN: Tubing cutter, tube bender, flaring kit, swaging tool, copper tubing, and flare nut.

YOU WILL: Cut, bend, flare, and swage tubing to an operational configuration.

HOW WELL: You must complete the Knowledge Test with 90% accuracy and the Performance Test with 100% accuracy.

ENABLING OBJECTIVES:

1. Identify types and sizes of tubing and pipe.
2. Identify types and sizes of fittings.
3. Measure and cut tubing for specific applications.
4. Bend copper tubing.
5. Flare copper tubing.
6. Swage copper tubing.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1

NUMBER

ENABLING OBJECTIVE:

Identify types and sizes of tubing and pipe.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read resource #1 for determining how to size and identify the types of tubing.	1. Modern Refrigeration and Air Conditioning, page 37-39 paragraph 2 thru 2-10.
2. Read resource #2 for determining how to size and identify the types of aluminum tubing.	2. Instruction sheet for enabling ojective #1, Learning Guide, page 4.
3. Read resource #3 for determining how to size and identify the types of pipe.	3. Instruction sheet for enabling objective #1, Learning Guide, page 5-6.
4. Complete resource #4, by examining selected tubing samples.	4. Check out tubing samples from instructor and examine and identify the various types of tubing.
5. Complete resource #5, self check, written, for enabling objective number 1.	5. Self check, written, for enabling objective #1, Learning Guide, page 7.
6. Complete resource #6, self check, performance, for enabling objective number 1.	6. Self check, performance, for identifying tubing and pipe, Learning Guide, page 10.
7. After successfully completing resources 5 and 6, self check for enabling objective number 1, go on to enabling objective number 2.	

Aluminum Tubing

Aluminum tubing is used primarily in household refrigerator evaporators. It is sized according to outside diameter (OD) and is purchased in rolls in varying lengths. Aluminum tubing does not have as much heat transfer capability as copper tubing but is much cheaper to manufacture. Since aluminum tubing is lightweight and very soft, it is easily formed by hand so there is very little need to use fittings. Soft soldering with special alloys is used to join aluminum tubing. Repairs to aluminum evaporators are often made with an epoxy compound or by the soft soldering process.

PIPE

Different kinds of pipe are used in the installation and repair of mechanical systems. Each type of pipe is made for a specific use. Pipe is made to provide water tight, gas tight or air tight joints. Iron and steel pipe are commonly used in installing permanent mechanical systems.

It is important for technicians to have a good knowledge of fitting iron and steel pipe. The technician must have the ability to study blue prints and plan a job so that the correct equipment and materials will be procured. A good technician will always prepare a checklist of necessary items.

PURPOSE OF PIPE

A pipe for plumbing purposes is a hollow cylinder used for conveyance of liquids or gases and is usually threaded at the ends for coupling. Pipe that is used by the mechanical technician is measured by inside diameter (ID).

TYPES OF PIPE

Black Iron (Uncoated)-Black iron is composed of mild steel mixed with cast or pig iron. This type of pipe is most commonly used for compressed gases (air, gaseous fuels), steam and condensate returns, and oil. However, it is not recommended for sewer lines due to rust and stoppage.

Steel-Steel pipe is a composition of scrap iron.

Galvanized (Coated)-Coated pipe is either black iron or steel pipe that has been dipped in a zinc bath solution. It is used for hot and cold water distribution and drain lines. It is not normally used for natural gas lines due to flaking action of the zinc coating which may cause blockage of orifices and small passages.

Sizes of Pipe:

Pipe is usually furnished in 21 foot lengths and normally comes with inside diameters (ID) of 1/8", 1/4", 3/8", 1/2", 3/4", 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 3 1/2", 4", 5", 6", 8", 10", and 12".

Classes of Pipe:

There are primarily three classes of pipe used by mechanical technicians.

Standard weight (125 psi)
Extra strength (250 psi)
Double extra strength (600 psi)

SELF-CHECK FOR ENABLING OBJECTIVE 1
NUMBER

DIRECTIONS:

Evaluate your work by answering the following questions on a separate sheet of paper.

1. Most tubing used in refrigeration and air conditioning is made of ____________________.
2. All tubing used in air conditioning and refrigeration work is carefully processed to be sure that it is ____________________.
3. Most tubing used in air conditioning and refrigeration is the ______________________ thickness.
4. When soft copper tubing is annealed, that means it is ________________________.
5. In what lengths are rolls of soft copper tubing available?
6. What happens to soft copper tubing when it is bent or hammered on?
7. Copper tubing used in refrigeration and air conditioning is measured by ____________?
8. What length does hand drawn tubing come in?
9. Why should steel tubing be used in R-717 (ammonia) systems instead of copper tubing?
10. What are some applications where nominal size copper tubing is used?
11. When is nominal size copper tubing used in connection with refrigerants?
12. Outside diameter (OD) size is ________________ larger than nominal size.
13. What type of tubing is used primarily in domestic refrigerators?
14. Aluminum tubing is lightweight, very soft, and is easily formed by hand requiring the use of very few ________________________.

15. What type of pipe should be used for natural gas lines?
16. What type of pipe is used for hot and cold water distribution and drain lines?
17. Why is galvanized (coated) pipe not normally used for natural gas lines?
18. What length is pipe usually furnished in?
19. What is the psi rating of extra strength pipe?
20. Pipe which is used for water and drain lines is measured by ______________.

SELF-CHECK FOR ENABLING OBJECTIVE 1
NUMBER

ANSWER KEY

1. copper
2. clean and dry
3. L, medium wall
4. heated
5. 25, 50, and 100 foot lengths
6. work hardening
7. outside diameter
8. 20 foot
9. There is a chance for chemical reaction (corrosion) between ammonia and copper.
10. water and drain lines
11. never
12. 1/8 inch
13. aluminum
14. fittings
15. black iron
16. galvanized
17. due to flaking action of its zinc coating which may cause blockage of orifices and small passages.
18. 21 foot
19. 250
20. inside diameter

If you answered any questions incorrectly, go back and repeat one or more of the Learning Activities for this Enabling Objective before proceeding on.

SELF-CHECK FOR ENABLING OBJECTIVE 1
NUMBER

DIRECTIONS:

The tubing and pipe samples are numbered (from sample listed in learning activity #4). Identify each sample by writing type and size opposite the number that corresponds to the tubing sample. Under application explain where the sample should be used. Use a separate sheet of paper for your answers.

Sample No.	Type	Size (Dimention & Length)	Application
1.			
2.			
3.			
4.			
5.			

SELF-CHECK FOR ENABLING OBJECTIVE 1

NUMBER

ANSWER KEY

Sample No.	Type	Size	Application
1.	Copper	3/8" x 6"	AC&R
2.	Aluminum	3/8" x 4"	Evaporators
3.	Galvanized	1/2" x 5"	Water & Drain Lines
4.	Copper	1/2" x 4"	AC&R
5.	Copper	3/4" x 6 1/2"	AC&R

If you identify any samples incorrectly, go back and repeat one or more of the Learning Activities for this Enabling Objective before proceeding on.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2

NUMBER

ENABLING OBJECTIVE:

Identify types and sizes of fittings.

PROCEDURE	
LEARNING ACTIVITIES	RESOURCES
1. Read resource #1 for determining how to size and identify tubing fittings.	1. Modern Refrigeration and Air Conditioning, page 44 paragraph 2 thru 2-18 through 2-20 and page 50, paragraph 2-26.
2. Read resource #2 for determining how to size and identify tubing and pipe fittings.	2. Instruction sheet for enabling objective #2, Learning Guide, page 13-18.
3. Read resource #3, by examining selected fitting samples.	3. Fitting display board. Identification of fittings are contained in Learning Guide page 19.
4. Complete resource #4, self check written, for enabling objective #2.	4. Self check, written, for enabling object #2, Learning Guide page 22.
5. Complete resource #5, self check performance for enabling objective #2.	5. Self check, performance, for enabling objective #2, Learning Guide page 24.
6. After successfully completing resources 4 and 5, self check for enabling objective #2, go on to enabling objective #3.	

FITTINGS

Fittings are used to join two or more refrigeration lines together or to connect one or more lines to a unit. While all fittings have the same purpose, they may differ in composition, type, size, thread and shape.

Fittings used in a refrigeration system may be made of several kinds of metals, depending on the type of refrigerant used, pressure on the lines and size of the units.

Types of Fittings:

Common types of fittings used in refrigeration systems consist of sweat, (figure 1), flare (figure 2 and 3), and pipe (figure 4).

Refrigeration flare type fittings differ from many commercial fittings. This difference is in the cone angle; therefore, no attempt should be made to substitute other fittings of this type.

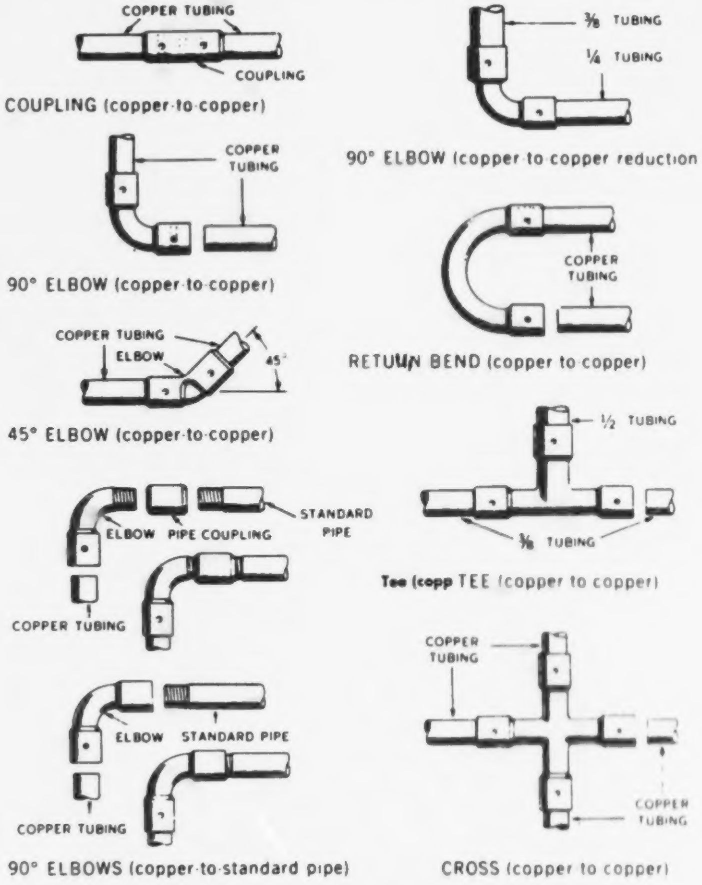

COPPER TUBING
COUPLING
COUPLING (copper-to-copper)
⅜ TUBING
¼ TUBING
90° ELBOW (copper-to-copper reduction
COPPER TUBING
90° ELBOW (copper-to-copper)
COPPER TUBING
RETUUN BEND (copper to copper)
COPPER TUBING
ELBOW
45°
45° ELBOW (copper-to-copper)
½ TUBING
⅜ TUBING
Tee (copp TEE (copper to copper)
ELBOW
PIPE COUPLING
STANDARD PIPE
COPPER TUBING
ELBOW
STANDARD PIPE
COPPER TUBING
90° ELBOWS (copper-to-standard pipe)
COPPER TUBING
COPPER TUBING
CROSS (copper to copper)

Figure 1, Sweat Fittings (Copper)

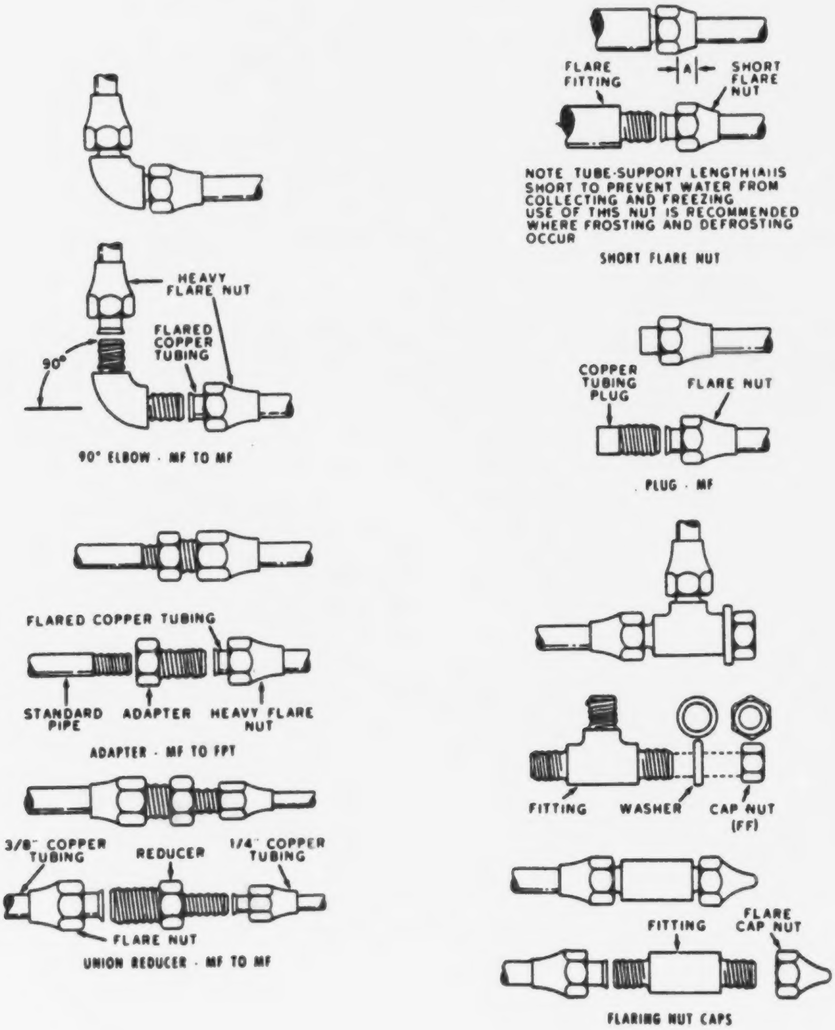

HEAVY FLARE NUT
FLARED COPPER TUBING
90°
90° ELBOW - MF TO MF
FLARED COPPER TUBING
STANDARD PIPE
ADAPTER
HEAVY FLARE NUT
ADAPTER - MF TO FPT
3/8" COPPER TUBING
REDUCER
1/4" COPPER TUBING
FLARE NUT
UNION REDUCER - MF TO MF
FLARE FITTING
A
SHORT FLARE NUT
NOTE TUBE-SUPPORT LENGTH (A) IS SHORT TO PREVENT WATER FROM COLLECTING AND FREEZING
USE OF THIS NUT IS RECOMMENDED WHERE FROSTING AND DEFROSTING OCCUR
SHORT FLARE NUT
COPPER TUBING PLUG
FLARE NUT
PLUG - MF
FITTING
WASHER
CAP NUT (FF)
FITTING
FLARE CAP NUT
FLARING NUT CAPS

Figure 2, Flare Fittings (Brass)

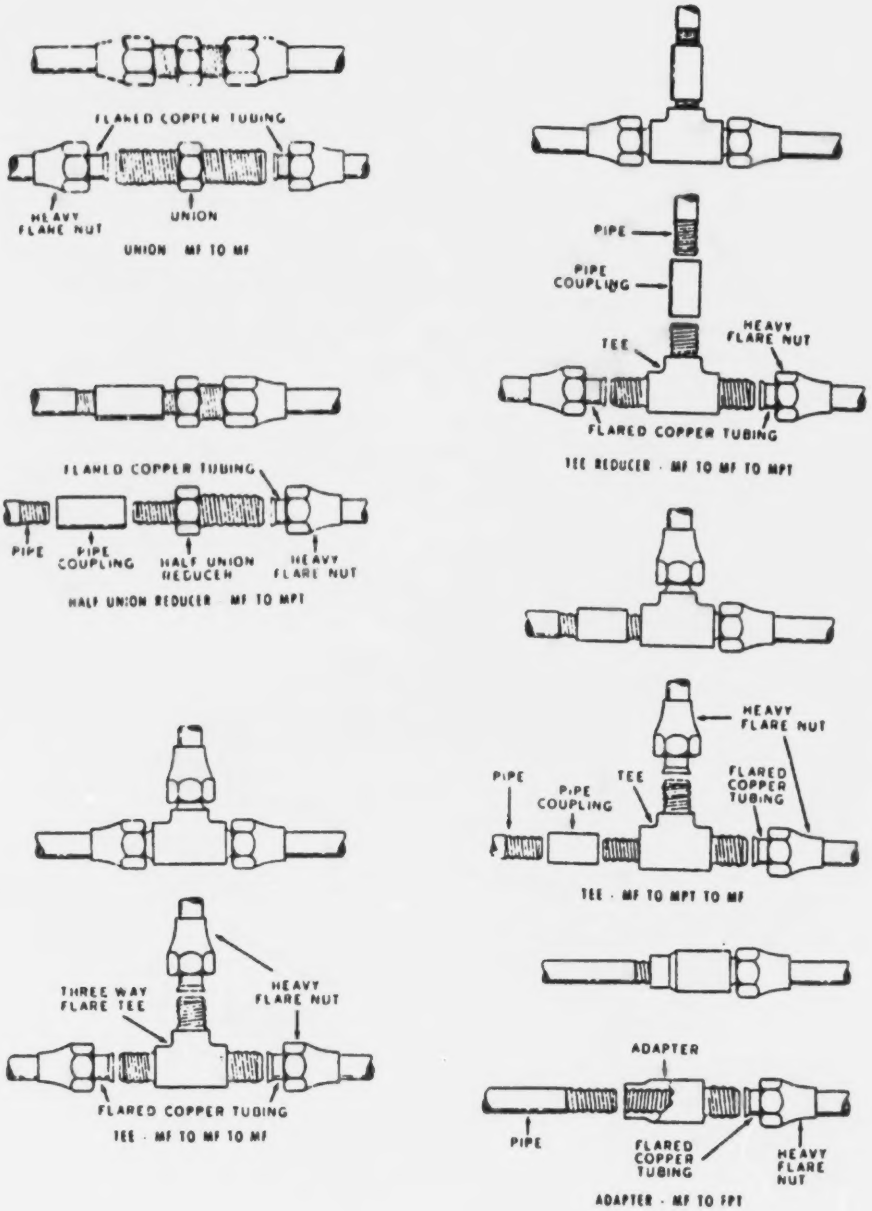

FLARED COPPER TUBING
HEAVY FLARE NUT
UNION
UNION · MF TO MF
FLARED COPPER TUBING
PIPE
PIPE COUPLING
HALF UNION REDUCER
HEAVY FLARE NUT
HALF UNION REDUCER · MF TO MPT
THREE WAY FLARE TEE
HEAVY FLARE NUT
FLARED COPPER TUBING
TEE · MF TO MF TO MF
PIPE
PIPE COUPLING
TEE
HEAVY FLARE NUT
FLARED COPPER TUBING
TEE REDUCER · MF TO MF TO MPT
HEAVY FLARE NUT
PIPE
PIPE COUPLING
TEE
FLARED COPPER TUBING
TEE · MF TO MPT TO MF
ADAPTER
PIPE
FLARED COPPER TUBING
HEAVY FLARE NUT
ADAPTER · MF TO FPT

Figure 3, Flare Fittings (Brass)

PIPE FITTINGS AND THEIR USE

Pipe fittings are measured by inside diameter and the size is proportionate to the outside diameter of the pipe. Example: a 1/2" fitting will accomplish a 1/2:" pipe although the inside diameter of the fitting may be 3/4". Pipe fittings are fabricated in malleable iron for use with steel pipe and in black iron or galvanized.

Types of Fittings

Following are types of pipe fittings that you may be using at some time. See figure 4.

ELBOWS

- Female threads (inside)
- 90 degree (makes a 90-degree change in direction)
- 45 degree (makes a 45-degree change in direction)
- 90 and 45 degree street elbows
  - One female and one male thread
  - Allows for close installation of fittings
  - Eliminates a pipe nipple
- Reduce elbow
  - 90 and 45 degrees
  - Two female threads
  - Used to reduce from one size to another

TEES

- Three female threads
- Used to pick up a branch run at a 90-degree angle
- Reducing tees
  - Used to couple three lines of different sizes

Service tee
- Two female and one male thread
- For close installation
- Eliminates use of a nipple

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 2
NUMBER

CROSS

- Four female threads
- Four outlets 90 degrees apart
- Used on most steam boilers below and above water column

UNIONS

- Ground joint or machined face
- Two female threads
- Eases removing or installing a section of pipe or equipment

COUPLINGS

- Female threads
- Joins straight runs of pipe
- Straight or plain coupling
  - Furnished with each length of pipe
  - Serves as a thread protector

NIPPLES

- A piece of pipe less than 12" long, threaded on both ends
- Close nipple (all-thread)
  - Threaded full length
- Short nipple (shoulder)
  - Threaded both ends with a shoulder between
- Long nipples
  - Two to twleve inches long
- Nipples are used where short pieces of extensions of pipe are required

PIPE PLUG

- Male thread on one end only
- Square or hexagon head
- Used to close off an opening in a valve or fitting

PIPE CAP

One female thread
Used to close off an opening on a piece of threaded pipe

REDUCERS

Bushing
  One female and one male thread
  Used to reduce size of an opening in a valve or fitting
  Read largest male thread end first
Bell reducer
  Two female threads
  Used to make reduction in run of pipe

Measuring, Cutting, Reaming, Threading and Fitting Pipe

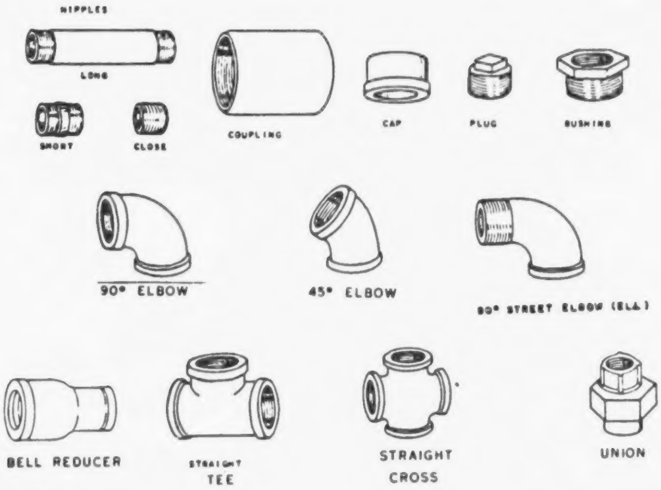

NIPPLES
LONG
SHORT
CLOSE
COUPLING
CAP
PLUG
BUSHING
90° ELBOW
45° ELBOW
90° STREET ELBOW (ELL)
BELL REDUCER
STRAIGHT TEE
STRAIGHT CROSS
UNION

Figure 4, Pipe Fittings

Fitting Display Board: (See your instructor for location of the display board)

Study the fittings on the fitting display board and determine if you can correctly identify each fitting. You may use your textbook or learning guide information sheets to help you to identify the fittings correctly and double check your answers. In order to determine if you really understand this information it is recommended that you write down your answers on a separate sheet of paper, and when you have identified all fittings on the board check your answers with those on page 20-21 of this learning guide. When you are confident that you have mastered the fitting display board you should move on to your next learning activity.

Example of the typical answer statement concerning fittings.

1. Fitting refrigeration , copper, 180 degree return bend 3/8" sweat x 3/8" sweat

1. Fitting, refrigeration, copper, 180 degree return bend 3/8" sweat x 3/8" sweat
2. Fitting, refrigeration, copper, coupling, 7/8" sweat x 7/8" sweat
3. Fitting, refrigeration, copper, tee, 3/8" sweat x 3/8" sweat x 3/8" sweat
4. Fitting, refrigeration, copper, adapter, 7/8" sweat x 3/4" MPT (male pipe threads)
5. Fitting, refrigeration, copper, adapter, 5/8" sweat x 1/2" FPT (female pipe threads)
6. Fitting, refrigeration, copper, reducing coupling, 7/8" sweat x 5/8" sweat
7. Fitting, refrigeration, copper, elbow 90 degree, 7/8" sweat x 3/4" sweat
8. Fitting, refrigeration, copper, elbow 45 degree, 3/4" sweat x 3/4" sweat
9. Fitting, refrigeration, copper, elbow 90 degree, 1/2" sweat x 1/2" sweat
10. Fitting, pipe, galvanized, street elbow 90 degree, 3/4" x 3/4"
11. Fitting, pipe, black iron, elbow 90 degree, 1/2" x 1/2"
12. Fitting, pipe, galvanized, tee, 1/2" x 1/2" x 1/2"
13. Fitting, pipe, galvanized, bell reducer, 1/2" x 3/8"
14. Fitting, pipe, galvanized, bushing, 3/4" x 1/2"
15. Fitting, pipe, black iron, union, 1/8" x 1/8"
16. Fitting, pipe, galvanized iron, nipple, 3" x 1/2"
17. Fitting, compression, brass, cross, 3/8" x 3/8" x 3/8" x 3/8"
18. Fitting, refrigeration, brass, flare nut standard, 1/2"
19. Fitting, compression, brass, half union with check valve, 3/8" x 1/4" MPT
20. Fitting, refrigeration, brass, union, 3/8" flare x 1/4" flare
21. Fitting, refrigeration, brass, flare nut, short, 1/4"
22. Fitting, refrigeration, brass, elbow 90 degree, drop eared, 1/2" x 1/2"

23. Fitting, refrigeration, brass, plug, 1/4" flare
24. Fitting, compression, brass, union with panel mount, 3/8" x 3/8"
25. Fitting, compression, brass, union, reducing, 1/2" x 1/4"
26. Fitting, refrigeration, brass, tee, 3/8" flare x 3/8" flare x 1/4" MPT
27. Fitting, refrigeration, brass, tee, 3/8" flare x 3/8" flare x 3/8" flare
28. Fitting, refrigeration, brass, elbow 90 degree, 3/8" flare x 3/8" flare
29. Fitting, refrigeration, brass, elbow 90 degree, 1/4" flare x 3/8" MPT
30. Fitting, refrigeration, brass, elbow 45 degree, 3/8" flare x 1/4" MPT
31. Fitting, refrigeration, brass, adapter, 1/4" flare x 3/4" MPT
32. Fitting, refrigeration, brass, half union, 1/2" flare x 1/2" MPT
33. Fitting, refrigeration, brass, flare nut, long 3/8"
34. Fitting, refrigeration, brass, flare nut, short 3/8"
35. Fitting, refrigeration, brass, half union, 1/4" flare x 3/8" female flare
36. Fitting, refrigeration, brass, half union, 3/8" flare x 1/4" MPT
37. Fitting, refrigeration, brass, union, 1/4" flare x 1/4" flare

SELF-CHECK FOR ENABLING OBJECTIVE 2
NUMBER

DIRECTIONS:

Evaluate your work by answering the following questions on a separate sheet of paper.

1. Name the three major types of fittings.
2. Name two types of flare nuts.
3. How are sweat fittings measured?
4. How are flared fittings measured?
5. How are pipe fittings measured?
6. Code No. 3 indicates the fitting fits 3/16" tubing. What code number would fit 3/8" tubing?
7. Most flares are made at what degree angle?
8. What type of material is used to make flare nuts?
9. What size of flare nut is recommended for use where frosting and defrosting occur?

SELF-CHECK FOR ENABLING OBJECTIVE 2

NUMBER

ANSWER KEY

1. Sweat, flare and pipe
2. Short shank and long shank
3. Inside diameter (ID)
4. Outside diameter (OD) of the cone
5. Inside diameter (ID)
6. No. 6
7. 45
8. Brass
9. Short shank

If you answerred any questions incorrectly, go back and repeat one or more of the Learning Activities for this Enabling Objective before proceeding on.

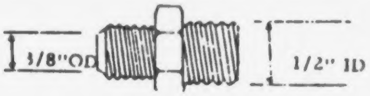
SELF-CHECK FOR ENABLING OBJECTIVE 2

NUMBER

DIRECTIONS:

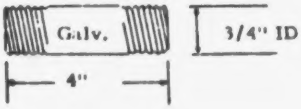
Identify the following illustrated fittings by writing the correct description on a separate sheet of paper as per the example.

Example:

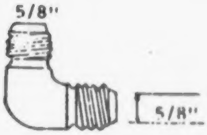


Fitting, refrigeration, brass, half union reducer, 3/8" flare to 1/2" male pipe thread.

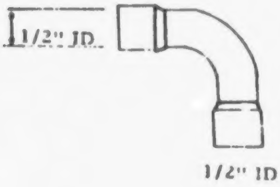
1.



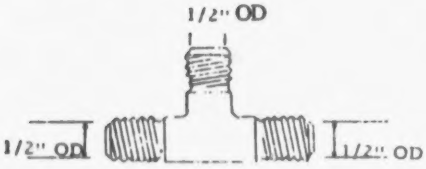
2.



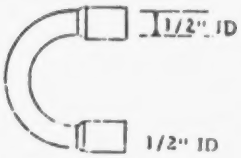
3.



4.


1/2" OD
1/2" OD
1/2" OD

5.



SELF-CHECK FOR ENABLING OBJECTIVE 2

NUMBER

ANSWER KEY

1. Fitting, pipe, galvanized, nipple, 4" x 3/4"
2. Fitting, refrigeration, brass, elbow, 90 degree 5/8" flare x 5/8" flare
3. Fitting, refrigeration, copper, elbow,, 90 degree 1/2" sweat x 1/2" sweat
4. Fitting, refrigeration, brass, tee 1/2" flare x 1/2" flare x 1/2" flare
5. Fitting, refrigeration, copper, 180 degree return bend 1/2" sweat x 1/2" sweat

If you identified any of the fittings incorrectly, go back and repeat one or more of the Learning Activities for this Enabling Objective before proceeding on.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3
NUMBER

ENABLING OBJECTIVE:
Measure and cut tubing for specific applications.

PROCEDURE	
LEARNING ACTIVITIES	RESOURCES
1. Read resource #1 for determining how to cut tubing.	1. Modern Refrigeration and Air Conditioning, page 40, paragraph 2-11.
2. View resource #2 for demonstration on cutting tubing.	2. Video tape, "Cutting Tubing". Location: MET Resource Center
3. Complete resource #3, practice cutting tubing.	3. Instruction sheet for enabling objective #3, Learning Guide, page 27.
4. Complete resource #4, self check for enabling objective #3.	4. Self check, for enabling objective #3, Learning Guide, page 28.
5. After successfully completing resource #4, self check for enabling objective #3, go on to enabling objective #4.	

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 3

NUMBER

Check out a tubing cutter and enough scrap copper to cut ten pieces 2" long by using the following instructions.

1. Measure and mark the tubing 2" from the end.
2. Install the tubing cutter so that the cutter wheel is over the mark.
3. Tighten the cutter wheel slightly (1/4 turn) against the tubing and revolve the cutter slowly around the tubing.
4. Continue revolving cutter, tightening slightly (approximately 1/4 turn) after each turn until the tube is cut through.
   CAUTION: Be careful not to drop the cutter and the tube when the cut is completed.
5. Remove the cutter and insert reamer in the end of the tubing. Revolve the reamer until the burr is removed from the inside of the tubing.
   NOTE: The reaming procedures should be done with the open end of the tube pointing down so the filings will not fall into the tube.
6. Inspect the tube. If it is still rough on the end, smooth it very lightly with reamer.

Have the instructor check your work before proceeding on.

SELF-CHECK FOR ENABLING OBJECTIVE 3

NUMBER

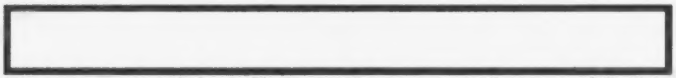
DIRECTIONS:

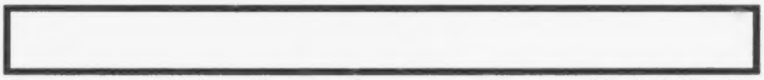
Evaluate your work by answering the following questions on a separate sheet of paper and cut tubing to the specifications outlined in questions 4 and 5. Check out enough tubing to complete this work.

1. What tools are used to cut copper tubing?
2. What precautions should be observed when using cutting tools?
3. How may a full-wall thickness be obtained after cutting a piece of tubing?
4. Cut one piece of 3/8" tubing 3 3/4" long.
5. Cut one piece of 3/8" tubing 4 1/8" long.

SELF-CHECK FOR ENABLING OBJECTIVE 3 NUMBER

ANSWER KEY

1. Hacksaw or tube cutter
2. Prevent filings or chips of any kind from entering the tubing.
3. File the end with a smooth or medium cut mill file.
4. 

   Does your tubing fit into the space above with 1/16" clearance?
   If your answer is yes, continue.
5. 

   Does your tubing fit into the space above with 1/16" clearance?
   If your answer is yes, continue.

If you answered any questions incorrectly or cut the tubing the wrong length, go back and repeat one or more of the Learning Activities for this Enabling Objective before proceeding on.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 4

NUMBER

ENABLING OBJECTIVE:

Bend copper tubing.

PROCEDURE	
LEARNING ACTIVITIES	RESOURCES
1. Read resource #1 for determining how to bend copper tubing.	1. Modern Refrigeration and Air Conditioning, page 40, paragraph 2-12.
2. View resource #2 for demonstration on bending copper tubing.	2. Video tape, "Bending Copper Tubing" Location: MET Resource Center
3. Complete resource #3, practice bending copper tubing.	3. Instruction sheet for enabling objective #4, Learning Guide, page 31-34.
4. Complete resource #4 self check for enabling objective #4.	4. Self check for enabling objective #4, Learning Guide, page 35.
5. After successfully completing resource #4, self check for enabling objective #4, go on to enabling objective #5.	

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 4
NUMBER

Check out a tubing cutter, bender, and a roll of 3/8" copper tubing and construct three 180 degree return bends with the goal of making their legs equal in length.

1. Unroll approximately three feet of the tubing.
2. Cut off three 8" pieces.
3. Bend tubing by using the following procedures.

GENERAL OPERATING INSTRUCTIONS

1. Raise form handle as shown in figure 5.

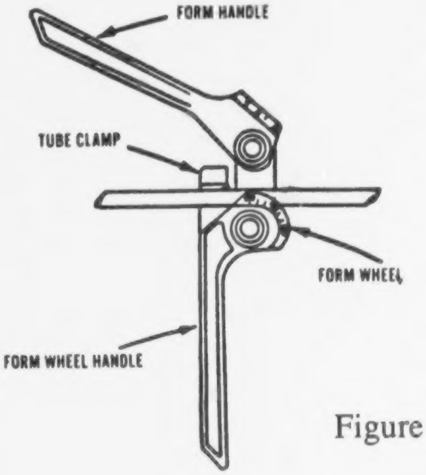


Figure 5

2. Position tubing as shown, using one of the three grooves provided on the form wheel. Also, be sure that the tube is engaged with the tube clamp. Use the groove that most closely conforms to the tubing when bending metric or other sizes of tubing that fall within the tool range.

3. Lower the form handle to position shown in figure 6.

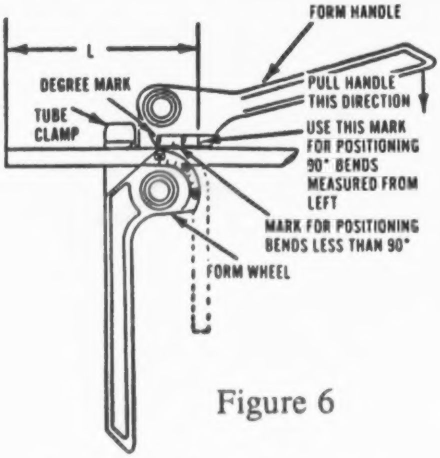

FORM HANDLE
L
DEGREE MARK
TUBE CLAMP
PULL HANDLE THIS DIRECTION
USE THIS MARK FOR POSITIONING 90° BENDS MEASURED FROM LEFT
MARK FOR POSITIONING BENDS LESS THAN 90°
FORM WHEEL

Figure 6

4. Then pull lever handle in direction of the arrow until the desired bend angle is obtained.

45 DEGREE BENDS AND OFFSET BENDS

A 45 degree bend may be made by measuring from the end of the tube to where the bend is to be located then place a mark at this point. Place the tube in the bender so that the mark on the tube is located directly in line with the graduation on the form handle shown in figure 6. This same graduation is used when measurement is made from either the left or the right side.

90 DEGREE BENDS

1. Measure from the end of the tube (first bend) and place a mark on the tubing.
2. Position the tube in the bender as shown. If the end from which you measured is on on the tube clamp side, the measured mark should be directly under the graduation marked "L" and located on the right side of the form lever as shown in figure 6 (page 32).
3. If the end from which you measured is placed on the right side of the tube clamp, set the mark on the tube directly under the graduation marked "R" on the form lever as shown in figure 7. With a steady motion, pull form level handle around until the zero degree mark is directly opposite the 90 degree mark on the form wheel.

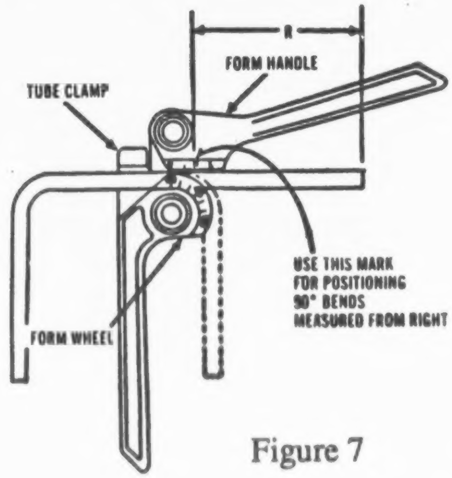


Figure 7

180 DEGREE BENDS

1. Measure the exact center of the piece you have cut off and mark. It should be 4". This is known as the "Center Mark".
2. To make a 180 degree bend and have the legs of the bend the same length, measure back to the left of the Center Mark 15/16" and mark. This is known as the "Start Mark".
3. Measure to the right of the Center Mark 15/16" and mark. This is known as the "Continuation Mark".
4. Select the correct slot on the bender for 3/8" tubing.
5. Place the Start Mark adjacent to the "L" on the handle making sure the tubing is in the bender securely, as shown in figure 2.

6. Pull handle down until the 0 on the handle is adjacent to the 90 degree mark on the form wheel.

7. Reposition tubing so that that the Continuation Mark is adjacent to 0 on the handle and 00 on the form wheel.

8. Continue bending by pulling the handle down until you reach the 90 degree mark on the form wheel as shown in figure 7.

9. Remove tubing from bender.

Have the instructor check your three return bends before continuing on.

SELF-CHECK FOR ENABLING OBJECTIVE 4
NUMBER

DIRECTIONS:

Evaluate your work by answering the following questions on a separate sheet of paper.

1. How will improperly bent tubing effect its installation?
2. Why should tubing be bent gradually?
3. Explain the use of a spring bender.
4. For more accurate bending, which type bender is used?
5. What is the minimum radius for a tubing bend?

ANSWER KEY

1. It may cause strain on the fittings and could cause a line restriction.
2. There is less danger that the sudden stress will break or buckle the tubing.
3. It is used to make bends internally or externally.
4. Lever-type bender.
5. Between 5 and 10 times the diameter of the tubing.

If you answered any questions incorrectly, go back and repeat one or more of the Learning Activities for this Enabling Objective before proceeding on.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 5
NUMBER

ENABLING OBJECTIVE:

Flare copper tubing.

PROCEDURE	
LEARNING ACTIVITIES	RESOURCES
1. Read resource #1 for determining how to flare copper tubing.	1. Modern Refrigeration and Air Conditioning, page 41-44, paragraph 2-14, thru 2-16.
2. View resource #2 for demonstration on flaring copper tubing.	2. Video tape, "Flaring Copper Tubing" Location: MET Resource Center
3. Complete resource #3, practice flaring copper tubing.	3. Instruction sheet for enabling objective #5, Learning Guide, page 38.
4. Complete resource #4 self check for enabling objective #5.	4. Self check for enabling objective #5, Learning Guide, page 39.
5. After successfully completing resource #4, self check for enabling objective #5, go on to enabling objective #6.	

Check out a tubing cutter, flaring tools, 3/8" flare nut, file and enough scrap 3/8" copper tubing to make 6 flares and practice flaring by using the following instructions.

FLARING

1. Remove the burrs from one end of the tube.
2. Place a 3/8" flare nut on the tubing.
3. Place the tubing in the flaring block (see figure 8).

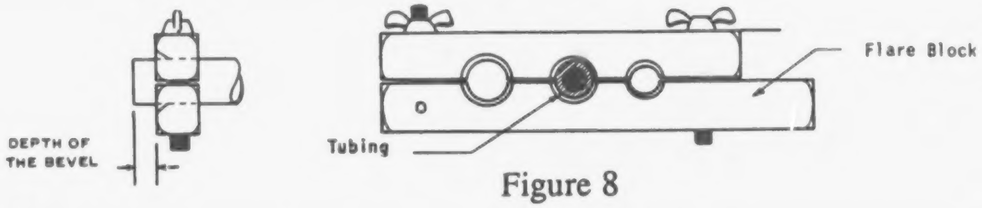


Figure 8

NOTE: The tubing should extend above the flaring block a distance equal to the depth of the depth of the level on the block.

4. Tighten the wing nuts on the flare block as tight as possible with your fingers.
5. Insert the flaring yoke over the flare block (see figure 9).

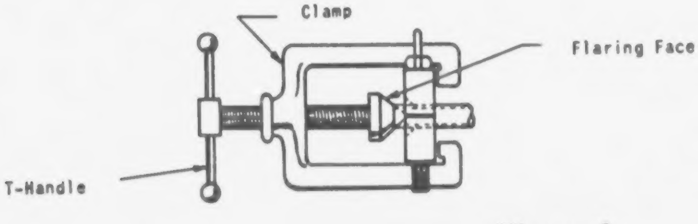


Figure 9

6. Tighten T-handle 3/4 turn moving the flaring face into the end of the tubing and then loosen. Continue this procedure until the flare is completed.
7. Remove the flaring yoke.
8. Loosen the wing nuts and remove the tubing.

Have the instructor check your work.

SELF-CHECK FOR ENABLING OBJECTIVE 5
NUMBER

DIRECTIONS:

Evaluate your work by answering the following questions on a separate sheet of paper.

1. What is the file used for in the flaring operation?
2. What are the two basic types of flares?
3. If a flare is too small, what may happen to it?
4. What may happen if you use just one continuous motion of the flaring tool, that is, without a back-and-forth motion?
5. What may happen if you tighten the spinning tool or yoke too much?

SELF-CHECK FOR ENABLING OBJECTIVE 5

NUMBER

ANSWER KEY

1. To square the end of the tube.
2. Single and double thickness flares.
3. It may be squeezed out of the fitting as the flare nut is tightened.
4. It may work to harden the tubing and make it more likely to split.
5. It will thin the wall of the tubing at the flare and weaken it.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 6

NUMBER

ENABLING OBJECTIVE:

Swage copper tubing.

PROCEDURE	
LEARNING ACTIVITIES	RESOURCES
1. Read resource #1 for determining how to swage copper tubing.	1. Modern Refrigeration and Air Conditioning, page 49-50, paragraph 2-24.
2. View resource #2 for demonstration on swaging copper tubing.	2. Video tape, "Swaging Copper Tubing" Location: MET Resource Center
3. Complete resource #3, practice swaging copper tubing.	3. Instruction sheet for enabling objective #6, Learning Guide, page 42.
4. Complete resource #4 self check for enabling objective #6.	4. Self check for enabling objective #6, Learning Guide, page 44.
5. When you have acquired the knowledge for this task, take the knowledge test.	5. Knowledge test E-01.
6. When you have acquired the necessary proficiency to accomplish this task, take the performance test.	6. Performance test E-01.

Check out a tubing cutter, 3/8" swaging tool, ball-peen hammer, and enough scrap 3/8" copper tubing to make 6 swages and practice swaging by using the following instructions.

SWAGING

1. Cut 6 pieces of 3/8" tubing in 2" lengths.
2. Ream one end of the copper tubing.
3. Insert one piece of the copper tubing in the swaging block as illustrated in figure 10.

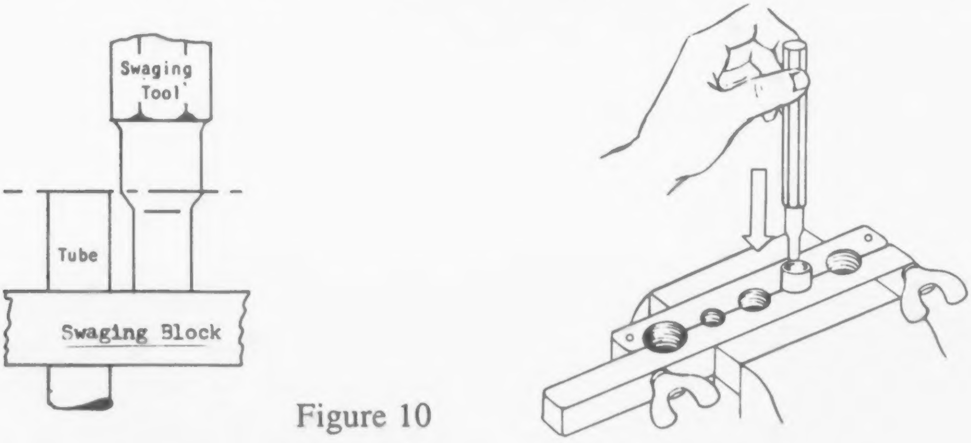


Figure 10

4. Insert the proper size swaging tool in the tubing as illustrated in figure 11.

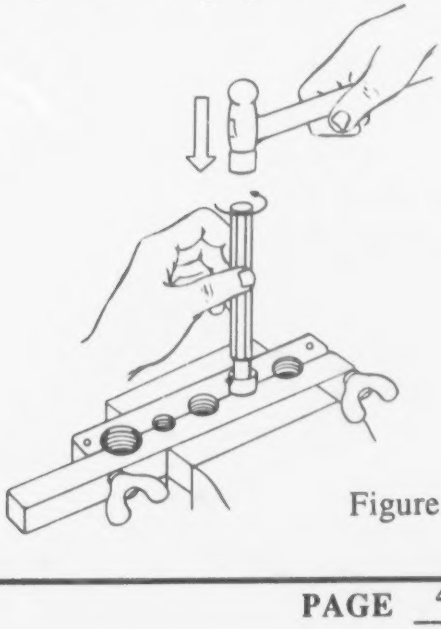


Figure 11

5. Use light strokes with a ball-peen hammer and drive the swaging tool into the tubing.

   NOTE: The swaging tool should be turned slightly after each stroke.

6. Remove the swaging tool.
7. Remove the tubing from the swaging block.
8. Have the instructor check your work.

SELF-CHECK FOR ENABLING OBJECTIVE 6
NUMBER

DIRECTIONS:

Evaluate your work by answering the following questions on a separate sheet of paper.

1. What does swaging permit?
2. What should be the length of the overlap?
3. What are the two types of swaging tools which are commonly used?

SELF-CHECK FOR ENABLING OBJECTIVE 6

NUMBER

ANSWER KEY

1. Swaging permits two pieces of soft copper tubing of the same diameter to be joined together without the use of fittings.
2. It should equal the outside diameter (OD) of the tubing.
3. The punch and lever type.

If you answered any questions incorrectly, go back and repeat one or more of the Learning Activities for this Enabling Objective before proceeding on.

KNOWLEDGE TEST FOR E 0 1

DUTY TASK NUMBER

DIRECTIONS:

The items below are multiple choice. On the separate answer sheet, mark the letter of the correct answer by darkening the letter to the right of the number in question. To successfully pass this test you must achieve a 90% score.

1. What is the meaining of AC and R as applied to tubing?

   a. It is cold rolled.
   b. It is air cooled rolled.
   c. It is a certain manufacturer's brand symbol.
   d. It is intended for air cooled applications only.
   e. It is suitable for air conditioning and refrigeration applications.

2. When cutting copper tubing, how may the chips be prevented from entering the length of tubing to be immediately used?

   a. Pinch the tube.
   b. Use a cutting fixture.
   c. Stuff rags in the tube.
   d. Apply air pressure on this length of the tube.
   e. Slant the tube so that the chips will not fall into the length being used.

3. What type of connections should be made when using soft copper tubing?

   a. Ferrel
   b. Welded
   c. Threaded
   d. Flared or soldered
   e. Flanged type fittings

4. Why should the end of the copper tubing which is to be flared be filed square?

   a. To keep the tubing bright.
   b. To keep the flare from splitting.
   c. To make the flare equal all around.
   d. To make the flare of proper thickness.
   e. To make it easy to attach the flaring tool.

5. Why are tubing benders used?

   a. To make a uniform fitting.
   b. To keep the tube from kinking.
   c. To provide a better grip on the tube.
   d. To keep the inside of the tube clean.
   e. To keep the outside of the tube clean.

6. Does swaging make the tubing ID larger or smaller?

   a. Larger
   b. Smaller
   c. No change
   d. Only the OD is larger
   e. Thickens the tubing wall

7. The food processing industry would most likely use what type of tubing?

   a. Flexible
   b. Copper
   c. Brass
   d. Plastic
   e. Stainless steel

8. How far above the swaging block should the tubing extend?

   a. 1/4 inch
   b. 3/8 inch
   c. 1/16 inch or more
   d. The length of the swage tool shoulder
   e. Twice the OD of the copper tubing

9. What OD tubing fits into a swaged 3/8 inch tubing?

   a. 1/4 inch
   b. 5/16 inch
   c. 3/8 inch
   d. 7/16 inch
   e. 1/2 inch

12. What may happen if a flare nut is drawn up too tight?

    a. The wrench may break.
    b. The tube will collapse.
    c. The oil will be squeezed out.
    d. The threads will always strip.
    e. The flare will be squeezed out.

13. Which two tools are used to cut copper tubing?

    a. Tubing cutter and diagonal pliers.
    b. Tubing cutter and tin snips.
    c. Tubing cutter and hacksaw.
    d. Hacksaw and pipe cutter.
    e. Hacksaw and coping saw.

14. Most soft copper tubing used for Air Conditioning and Refrigeration work is

    a. Sealed
    b. Annealed
    c. Dehydrated
    d. Sealed and annealed
    e. All of the above

15. Which type of tubing is used primarily on ammonia systems?

    a. Stainless steel
    b. Aluminum
    c. Plastic
    d. Copper
    e. Steel

16. What happens to soft copper tubing when it is bent too much?

    a. It becomes softer
    b. It becomes harder
    c. It becomes longer
    d. It becomes shorter
    e. None of the above

17. Flare fittings are sized by using

    a. The ID of the tubing
    b. The OD of the tubing
    c. The ID of the fitting
    d. The OD of the fitting
    e. All of the above

18. What is wrong if the tubing splits while it is being swaged?

    a. Tubing is too thin
    b. Tubing is too soft
    c. Tubing is too hard
    d. Swage tool is undersized
    e. Poor quality tubing

19. What type of pipe should be used for natural gas lines?

    a. Steel
    b. Galvanized
    c. Black iron
    d. Aluminum
    e. Copper

20. What are tee fittings used for?

    a. To couple one line to another
    b. To couple two lines together
    c. To couple three lines together
    d. To couple four lines together
    e. None of the above

PERFORMANCE TEST FOR E 0 1

DUTY TASK NUMBER

DIRECTIONS

1. Identify each of the fittings provided you (numbered 1 through 10) according to type and size. Put your answers on a separate sheet of paper. (See your instructor)
2. Given the necessary tools and supplies cut and bend one 8" length of 3/8" copper tubing, making a 180 degree return bend, flare one end and swage one end.

PERFORMANCE TEST FOR E 0 1
CONTINUED DUTY TASK NUMBER

PERFORMANCE STANDARDS

ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT

	YES	NO
1. Did the student identify all the fittings correctly?		
2. Is the length of the legs equal?		
3. Is the tubing not flattened or kinked?		
4. Is the flare equal all around?		
5. Is the flare of the proper depth?		
6. Is the flare smooth and not split on the end?		
7. Was the flare properly deburred, in that it has no inside ridge?		
8. Is the flare nut installed properly?		
9. Is the swage the proper depth?		
10. Will another piece of 3/8" tubing fit into the swage?		

INSTRUCTIONAL RESOURCES

TEXT

Although, Adrew D., Turnquist, Carl H., and Bracciano, Alfred F., Modern Refrigeration and Air Conditioning, Goodheart-Wilcox Co., Inc. South Holland, Illinois, 1982.

AUDIOVISUAL

"Cutting Tubing", Video Tape, TSTI-Amarillo

"Bending Copper Tubing", Video Tape, TSTI-Amarillo

"Flaring Copper Tubing", Video Tape, TSTI-Amarillo

"Swaging Copper Tubing", Video Tape, TSTI-Amarillo

TRAINING AIDS

"Fitting Display Board", TSTI-Amarillo

What the Learning Guide Did

After going through the sample learning guide, you should have noticed:

√ **1.** It "guided" students through selected learning activities and carefully developed learning materials that helped the student master a task (Fabricate Tubing).

√ **2.** It took advantage of learning materials already available. This particular sample referred students to a standard textbook, audio-visual presentations and other resources that were found to be appropriate.

√ **3.** Instead of trying to teach this rather complex task all at once, it split the task into six sections or phases called "enabling objectives".

√ **4.** The student was required to fully master each enabling objective (E.O.) before going on to the next. For each E.O. instruction was presented, the student was told to practice and then was given immediate feedback.

√ **5.** The instructor was actively involved in the learning process, but not as presentor of routine instruction. This was accomplished by a text book, video tapes and instruction sheets. The instructor's involvement was at critical points in the learning process: checking student progress, helping the student correct performance, answering questions and evaluating the student's overall mastery of the task.

√ **6.** The learning guide and resources referred to are complete. Everything the student needed was either included in the guide or was referred to specifically.

√ **7.** The learning guide is largely self-instructional. The student can spend most of the day actively engaged in learning the task and not asking questions like "What do I do next?'' or "Where do I go from here?".

√ **8.** The student can see precisely how he or she will be evaluated by looking at the performance test. The criteria for mastering the task is spelled out clearly.

How the Student Learning Guide Provides Key Elements Essential For Mastery Learning

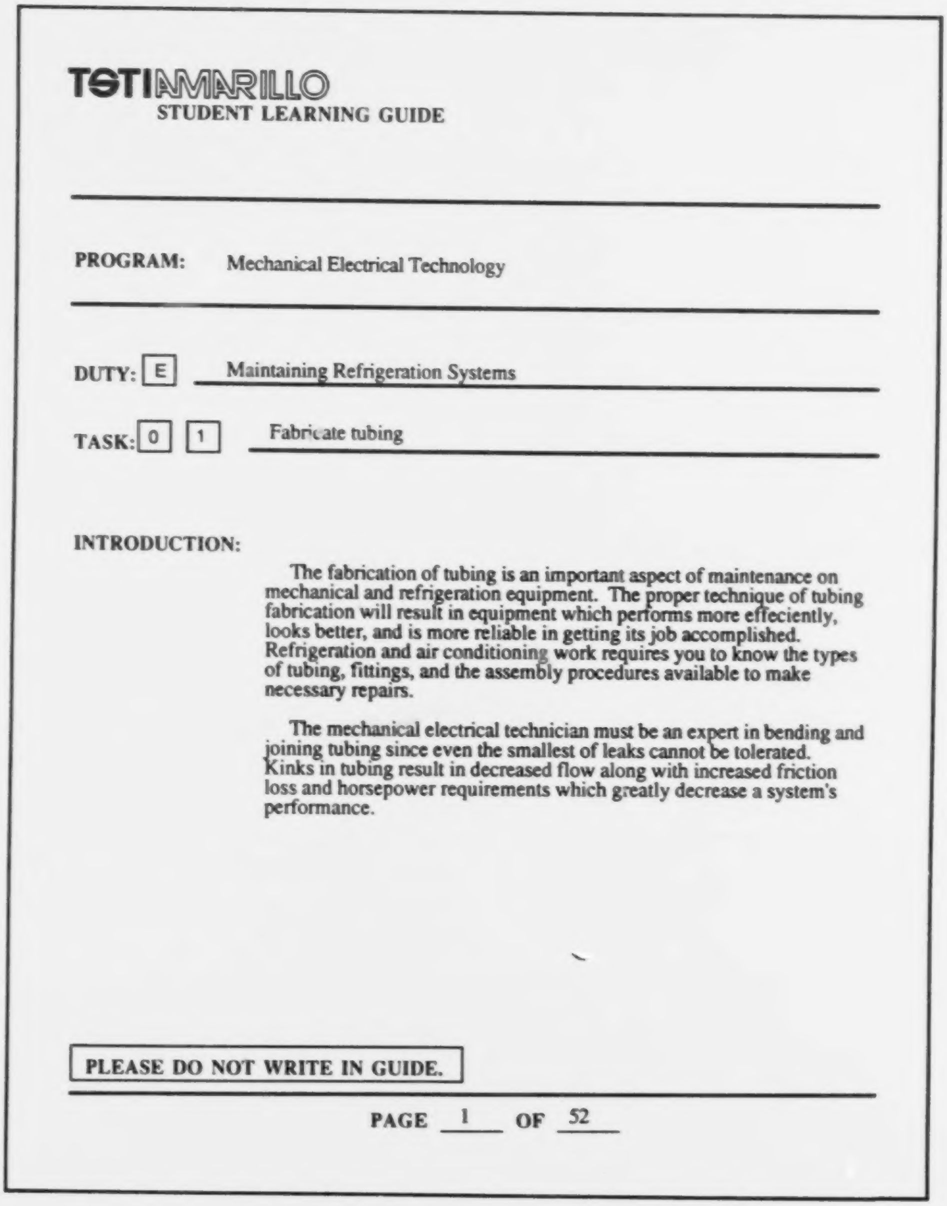
Essential Element of Mastery Learning	Component of Learning Guide	Comments
1. High Quality Instruction: a. Presentation of instruction appropriate for student and task.	Learning Resources: Instruction sheets, textbooks, video, other media, etc.	These were carefully selected or developed; each was chosen for its relevance to the task and the student. Notice that the student was presented with instructions with a variety of media (reading, tapes, drawings, etc.)
b. Active participation on the learner's part	Learning activities required the student to get up, move around, locate things, and to actually perform.	Going through the learning guide, the student is very involved. The student is required to actually practice or apply what was taught for each E.O. before going on to the next.
c. Immediate feedback and reinforcement	Self-checks, answer-keys, instructor check points	After practicing or applying what is taught for each E.O., a feedback device is used such as an answer key, a self-check or instructor check point. This also provides positive reinforcement and helps the student correct errors as they occur.
2. Sufficient Time to Learn	The "self-instructional" nature of the learning guide	The student can continue to work as long as is reasonably necessary to reach mastery. If needed, certain learning activities can be repeated.

Writing Student Learning Guides

Each component of a student learning guide will be discussed on the following pages. The preceding sample and information described a learning guide format currently in use at Texas State Technical Institute. Most learning guide formats are similar in design and content. Two additional sample learning guides are included in the resource section of this component. It is highly recommended that schools adopting learning guides, standardize on one format. Component E of the Resource Guide includes blank pages of the TSTI learning guide format.

The Cover Page

The cover page of each learning guide will look like the sample shown. Each component of the cover page is explained on the next page. Many schools also include a program logo on the cover sheet that graphically represents the occupation in which students are being trained for.



TSTI AMARILLO
STUDENT LEARNING GUIDE

PROGRAM: Mechanical Electrical Technology

DUTY: E Maintaining Refrigeration Systems

TASK: 0 1 Fabricate tubing

INTRODUCTION:

The fabrication of tubing is an important aspect of maintenance on mechanical and refrigeration equipment. The proper technique of tubing fabrication will result in equipment which performs more effeciently, looks better, and is more reliable in getting its job accomplished. Refrigeration and air conditioning work requires you to know the types of tubing, fittings, and the assembly procedures available to make necessary repairs.

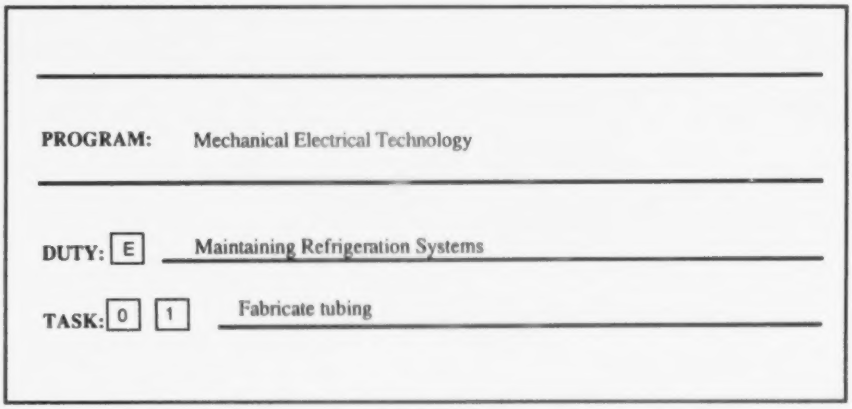
The mechanical electrical technician must be an expert in bending and joining tubing since even the smallest of leaks cannot be tolerated. Kinks in tubing result in decreased flow along with increased friction loss and horsepower requirements which greatly decrease a system's performance.

PLEASE DO NOT WRITE IN GUIDE.

PAGE 1 **OF** 52

COMPONENT: Duty and Task

Now let's look at each component of the Cover Page in more detail. The cover page should include the name of the training program, the **Duty**, the **Task** and the **Introduction**.



PROGRAM: Mechanical Electrical Technology

DUTY: E Maintaining Refrigeration Systems

TASK: 0 1 Fabricate tubing

Description: The Duty is restated exactly as it appears on the program's task listing. It begins with the "ing" form of an action verb to help distinguish between duties and tasks. The Task is a statement of exactly what the student will be able to do or know when he or she successfully completes the learning guide. It is taken directly from the program's task listing, begins with an action verb (i.e. replace, type, construct, calibrate, set-up, etc.) and is complete enough to describe what the student will be able to do.

Suggestion: Make sure the duty and task typed on the cover page are worded exactly the same as the duty and task statements listed on the approved program task listing. Remember, it is mandatory that a program have a validated task listing before writing learning guides.

COMPONENT: Introduction

INTRODUCTION:

The fabrication of tubing is an important aspect of maintenance on mechanical and refrigeration equipment. The proper technique of tubing fabrication will result in equipment which performs more effeciently, looks better, and is more reliable in getting its job accomplished. Refrigeration and air conditioning work requires you to know the types of tubing, fittings, and the assembly procedures available to make necessary repairs.

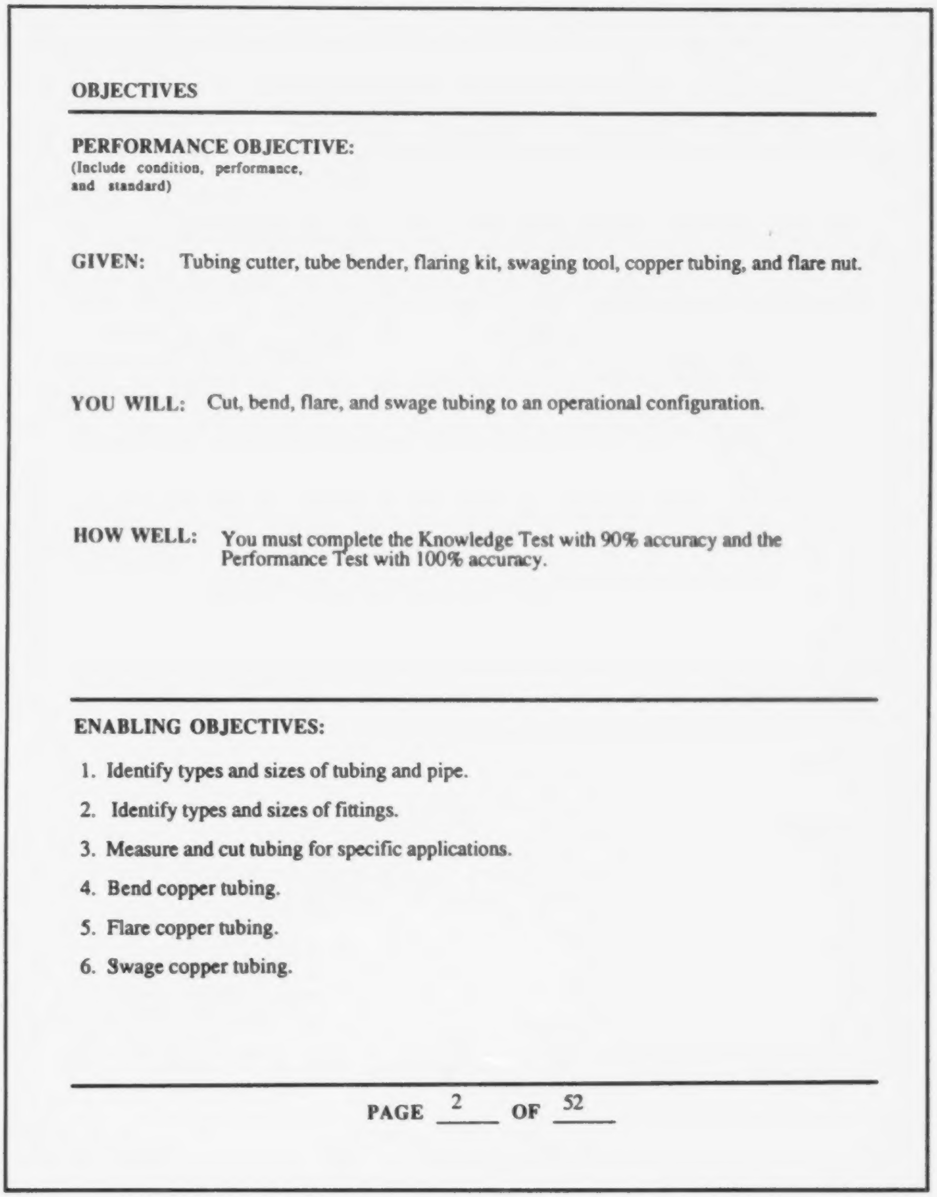
The mechanical electrical technician must be an expert in bending and joining tubing since even the smallest of leaks cannot be tolerated. Kinks in tubing result in decreased flow along with increased friction loss and horsepower requirements which greatly decrease a system's performance.

Description: The Introduction introduces the task to students and tells students why they should learn this task and learn it well. It is often 3-5 sentences in length, talks directly to the student and should create interest and motivate the student to want to learn. Sometimes it is best to write the introduction after the learning guide has been completed. This statement can also relate the task to the rest of the curriculum or course.

Suggestion: The Introduction can be one of the most difficult parts of the learning guide to write. Items you might mention include: how critical the task is to success on the job, how often it is performed, how later tasks in the program are built on this one, what might happen if the task is not performed properly, etc. Avoid meaningless statements like "This task is very important for the worker on the job". Tell the student specifically why it is important.

The Objectives Page

The second page of each Learning Guide will look like the example below:



OBJECTIVES

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: Tubing cutter, tube bender, flaring kit, swaging tool, copper tubing, and flare nut.

YOU WILL: Cut, bend, flare, and swage tubing to an operational configuration.

HOW WELL: You must complete the Knowledge Test with 90% accuracy and the Performance Test with 100% accuracy.

ENABLING OBJECTIVES:

1. Identify types and sizes of tubing and pipe.
2. Identify types and sizes of fittings.
3. Measure and cut tubing for specific applications.
4. Bend copper tubing.
5. Flare copper tubing.
6. Swage copper tubing.

PAGE 2 OF 52

COMPONENT: Performance Objectives

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: Tubing cutter, tube bender, flaring kit, swaging tool, copper tubing, and flare nut.

YOU WILL: Cut, bend, flare, and swage tubing to an operational configuration.

HOW WELL: You must complete the Knowledge Test with 90% accuracy and the Performance Test with 100% accuracy.

Description: The Performance Objective tells the student (and instructor) exactly how the student will be tested for mastery at the end of the learning guide; it describes the final testing situation. Students find it very helpful at the beginning of the learning guide to see how they will be tested at the end. The Given tells what things or situations students will be provided with or access to. The You Will tells exactly what students are to do to demonstrate mastery. The How Well indicates how well students must perform to reach mastery. (Performance objectives are discussed in Component B of the Resource Guide).

Suggestions: Given-only list major categories of items or tools the student will be given (tools, instruments, instruction manual, etc.). Avoid a long listing of specific items like screwdrivers, hammers, etc. You may want to list a situation or setting in which the student must perform ("at an actual job site", etc.). You can also mention things the student will not have access to ("without the use of a calculator", "without using instruction manual", etc.). Do not list things like books, slides, learning package, etc. that will be available in the learning situation.

You Will-this part of the objective is based on the task statement itself. Tell the student what you want them to actually do. It may be a restatement, refinement, or clarification of the task statement.

How Well-Rather than listing several criteria such as "all wires must be color matched"; "finish must be free of nicks" simply mention a minimum score on a knowledge and/or performance test. The test will list all specific criteria by which the student's performance will be judged. Most CBE programs use mastery scores of 100% for the performance test and 90-100% for the knowledge test. If the task being taught in the learning guide is knowledge only ("Describe the elements of effective design"), only a score on the knowledge test will be mentioned in the How Well statement. If the task is a skill there must be a performance test. If the task is a skill which incorporates concepts, theory, principles, or other knowledge, a performance test and a knowledge test will be needed. The Performance Objective should require the student to perform the actual task in as close to a job-like setting as possible.

COMPONENT: Enabling Objective

ENABLING OBJECTIVES:

1. Identify types and sizes of tubing and pipe.
2. Identify types and sizes of fittings.
3. Measure and cut tubing for specific applications.
4. Bend copper tubing.
5. Flare copper tubing.
6. Swage copper tubing.

Description: The Enabling Objectives (E.O.'s) are a very important part of the learning guide. Rather than teach the entire task all at once (i.e. "fabricate tubing"), the learning guide presents instruction in several sections. Content for enabling objectives is derived from task analysis which has already been discussed in a previous section of Component C. After the student receives instruction in the first E.O., he or she would then immediately practice it. The student would actually perform the procedure. Then, the student would receive immediate feedback on that practice. If the student makes a mistake, the error would be corrected, then and there. If the practice was correct, the student would be reinforced and would move on to the next Enabling Objective. The process would then be repeated for each E.O. No doubt, you can see that mastering the task several small sections at a time is far easier for the student than perhaps seeing a lengthy videotape covering the entire procedure all at once and then having to remember it. Each E. O. is necessary for the successful completion of the performance objective.

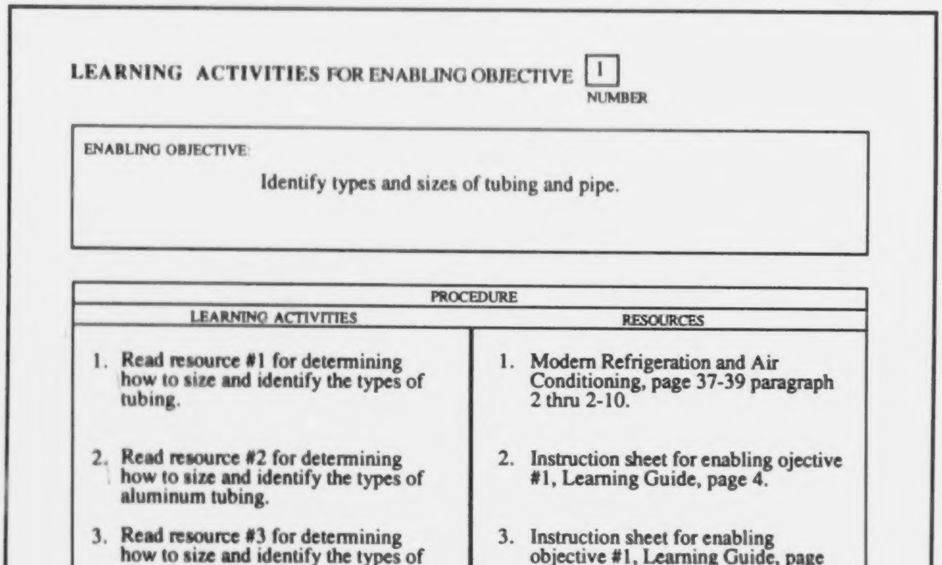
Suggestion: A learning guide will usually have between two and six E. O.'s although occasionally a task will be brief or simple enough to require only one (a restatement of the task) or complex enough to require more than six. Learning guides in use around the country often refer to the Enabling Objective as "sections", "micro—objectives", "sub-objectives" or "parts". Whatever they are called, their purpose is the same. Begin the Enabling Objectives with an action verb and describe exactly what the student will know or do at the end of that E. O. On the next page are typical situations around which enabling objectives are usually developed for learning guides. Task analysis will assist you in developing appropriate enabling objectives.

Typical Breakdown of Learning Guides into Enabling Objectives

Sample Task	Example of Enabling Objectives for Learning Guides	Objectives That Teach
Service disc brakes	1. Describe operation of disc brake system. 2. Remove wheels and inspect. 3. Replace pads and road test.	1. Theory, concept, facts, terms. 2. Major part of performing task. 3. Major part of performing task.
Weld 3 and 6 pass joints.	1. Set up station and tack weld plates. 2. Weld 3 pass joints. 3. Weld 6 pass joints.	1. Set up, preparation, etc. 2. Less complex variation of task. 3. More complex variation of task.
Measure and record sine waves and signals	1. Describe characteristics of sine waves. 2. Set up and calibrate scope. 3. Measure and record sine wave. 4. Measure and record signals.	1. Theory, concepts, facts, etc. 2. Operation of new specialized piece of equipment, tool, etc. 3. Major part of performing task. 4. Major part of performing task.
Assemble and test PVC joint	1. Measure and cut pieces. 2. Assemble joints. 3. Pressure test.	1. Preliminary part of doing task. 2. Major part of doing task. 3. Test, analysis, evaluation of results, etc.
Determine grades and angles with levels	1. Set up and adjust transit level 2. Determine grades. 3. Set up and adjust building's level 4. Determine angles.	1. Set up/operation of equipment. 2. Performing part of task. 3. Set up of additional piece of equipment. 4. Performing part of the task.
Repair leaking faucets	1. Identify types of and replace washers. 2. Repair and replace valve seats. 3. Replace valve assemblies.	1. Easiest and most common repair. 2. More difficult repair. 3. Most difficult repair.

COMPONENT: Learning Activities Page

Now, let's look at the heart of the learning guide, the Learning Activities page for each enabling objective. It should look like this:



LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1
NUMBER

ENABLING OBJECTIVE:
Identify types and sizes of tubing and pipe.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read resource #1 for determining how to size and identify the types of tubing.	1. Modern Refrigeration and Air Conditioning, page 37-39 paragraph 2 thru 2-10.
2. Read resource #2 for determining how to size and identify the types of aluminum tubing.	2. Instruction sheet for enabling ojective #1, Learning Guide, page 4.
3. Read resource #3 for determining how to size and identify the types of pipe.	3. Instruction sheet for enabling objective #1, Learning Guide, page 5-6.
4. Complete resource #4, by examining selected tubing samples.	4. Check out tubing samples from instructor and examine and identify the various types of tubing.
5. Complete resource #5, self check, written, for enabling objective number 1.	5. Self check, written, for enabling objective #1, Learning Guide, page 7.
6. Complete resource #6, self check, performance, for enabling objective number 1.	6. Self check, performance, for identifying tubing and pipe, Learning Guide, page 10.
7. After successfully completing resources 5 and 6, self check for enabling objective number 1, go on to enabling objective number 2.	

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Description: The Learning Activities section should guide the student through the learning process in a sequential logical fashion. This page doesn't actually "teach" the student anything about the E. O., the learning resources listed to the right provide the actual instruction. This page is the student's "road map" for learning a particular enabling objective. If the activities are appropriate, complete and well thought out, the student will not have difficulty. If not, the student will surely get lost along the way. IMPORTANT: Notice that there are sufficient and appropriate learning activities to accomplish three key events: PRESENTATION of instruction, PRACTICE or APPLICATION of what was presented and FEEDBACK on that practice. On every single learning activities page; you should include activities to accomplish all three elements.

It is very important to note that there will be one learning activities page for each enabling objective listed on the second page of the learning guide. If there are four E.O.'s listed then there would be four Learning Activities pages for each of the four E.O.'s.

Suggestion: The best procedure for selecting learning activities is to select the least elaborate (easiest for the student to use) and least costly strategy that will enable the learner to perform the specified task.

Remember there are three key events that should be included on the Learning Activities pages.

- **PRESENTATION of instruction**
- **PRACTICE of what was presented**
- **FEEDBACK on that practice**

Resources

Be extremely careful in selecting resources to support learning activities. The most expensive or complicated resource is not always the most effective. Remember the audience these resources are intended for and select accordingly. Make sure that resources are directly related to achieving the learning objective. The following listing describes several different kinds of resources and learning activities. These suggestions are not meant to be all inclusive, but are presented to stimulate the learning guide writer's own creative thinking.

1. Readings from textbooks of short relevant sections dealing specifically with the knowledge required to reach the objective. This may be a single reference or may be stated as alternate references from different books.

2. Examination or data-gathering from standard reference books of the vocational field (i. e. Machinist's Handbook, Graphic Standards, Reference Manual for Office Personnel).

3. Completion of a section of a programmed text or other programmed material.

4. Reading special materials available in the school library (i.e. books, periodical articles, etc.)

5. Solving practice problems in the skills component (i. e. computational problems, exercises, data processing).

6. Viewing or listening to individualized audio or audio-visual materials (i. e. slide-tapes, audiotapes, videotapes, film strips, etc.).

7. Observing or operating models, mock-ups or dummy set-ups to gain understandings of mechanisms or operating controls (i.e. cutaway rotary engine, set-up of electrical circuit, practice keyboard).

8. Role-playing of performance in a simulated situation. Students may take the principle role of the practitioner or the participating role of the customer, the assistant, or the audience.

9. Real-life performances in which the student functions for short periods of time under controlled conditions in an actual work situation or in a situation very close to real.

10. Observing a skilled vocational worker in a real work situation.

11. Videotaping of student performance to be viewed and used by the student to evaluate and improve his\her own performance.

12. Simulation experiences in which a student goes through a close approximation of a real-life performance with the conditions controlled and consequences minimized. "Case Studies" in which students write their reactions and responses to the given situation are also considered simulation experiences. Other examples are: using a mannequin in cosmetology,disassembling and assembling a non-functional aircraft engine, etc.).

13. Small-group experiences, when students at closely related points of achievement can get together to discuss, plan, or evaluate their work (i. e., discuss results of observation, plan for role-playing sessions, discuss professsional responsibilities).

14. Instructor demonstration of a procedure. There may be instructional situations in which the best solution is for the instructor to personally perform the procedure and describe it as students observe. Usually this will need to be done on an individual basis, but sometimes may be possible for small groups or even the total group.

15. Guest speakers or outside experts These classroom experiences may be listed in an appropriate learning guide and may be scheduled by the instructor at a time when many students are ready for the experience. Usually the nature of the topic is such that the whole group can benefit, even though they may not be at the same point in their learning.

16. Skill's practice, exercises or drill. Certain skills may require that the student not only be able to perform them correctly once, but require that the student be able to do them smoothly, speedily, and flawlessly every time. Learning activities may therefore specify practice periods in terms of time, number of repeated experiences, or quantity of production.

17. Memorization. The occupational competency may require or suggest that students can function best if they have committed specific information to memory. This is a legitimate activity in many areas (i.e. memorize the table of metric measures, memorize the Gregg characters, memorize the formula for lathe speeds, memorize a list of terms etc.).

18. Scaled-down performance. If the real performance is large in physical size, is complex because of the number of participants, or consumes a quantity of expensive materials, a limited performance or a scaled-down situation may give the student a better chance of gaining confidence or success and may be more instructionally efficient and practical (i.e. construct a scale model of a built-up roof construction, lay out an irrigation system on a land contour model, build a corner of a block wall etc.).

19. Reading instruction sheets specially prepared for the learning guide. These will be concise statements of very relevant information that are geared to the student's level, contain up-to-date information and are available from no other convenient source.

20. Performing experiments in the laboratory. Assign the student specific experiments to perform with specified equipment and processes, observe the results and report or use the results.

21. Writing technical reports, reactions to case studies, reports for class discussion etc. This activity may be particularly valuable in technical areas, but also may be useful in any occupational program in which writing skills are important.

22. Preparing visual materials. Gather information and produce such graphic materials as diagrams, schematic drawings, charts, graphs, maps, graphic solutions, styling illustrations, layouts and design sketches. Activities of this type are usually interesting to students, add variety to the learning activity and tend to reinforce learning.

23. Planning activities. An occupational competency may require that the student learn how to plan the job or operation. Planning may include selecting or designing the job, developing a sequence of procedures, figuring material and costs, noting checkpoints and safety cautions and devising evaluation standards.

24. Critique or evaluation experiences. In these, the student is asked to rate or evaluate an example of a finished product or service. The evaluation can also be of the work of a fellow student, the student's own work or a videotape of a performance. The final product may be a rating sheet, written report or oral report.

25. Cooperative student experiences in which two or more students work together in a learning activity. Many occupational tasks involve teamwork and it is proper for the learning activities to incorporate this. Activities that require heavy lifting, cooperative production techniques, worker interaction, or teamwork are appropriate cooperative learning activities.

Suggestions for Using Learning Activities

- Readings must be directly related to the instructional objective—the learning guide writer should not require the student to read an entire chapter just because it would be "nice to know" when a page or two is all that is really necessary to deliver the essential information.

- Don't be afraid to use some group activities. In CBE small groups of students working on related competencies tend to form themselves, and total class groups can be called together by the instructor for special purposes. You might specify that the learner perform before a group of peers (as in giving a presentation), or form a small group for a role-playing activity, or participate in a field trip. Group activities, properly used and interspersed in the program, will add variety and interest to student learning activities.

- Instructors should not be overused in routine learning activities, but must be available for their functions of supervising, helping students overcome learning difficulties and evaluation.

- Observation activities should be directed to achieving the competency and not undertaken simply in the vague hope that somehow the experience will be helpful. Observation time must be reasonably short. Arranging for observation must not be difficult for the student, or time consuming for the instructor.

- In competency-based education, skills demonstrated by the instructor will need to be limited. It is unrealistic and inefficient to expect the instructor to present elaborate demonstrations to each student individually as needed. Group demonstrations are not likely to take place at a time when all students will be ready to learn from them, except perhaps in the early phases of a program. Videotapes of an instructor giving a demonstration are easy to make and are very suitable for instruction.

- Every vocational instructor should be concerned with the improvement of student communication skills, but in most vocational areas the success in the program should not depend on the student's ability to read at a high level, or read or write skillfully at a high level (unless that skill is a requirement of the occupation the student is being trained for). Most learning activities, therefore, should not require high level communication skills, and evaluations should not be based on the student's ability to write. Of course, if the program competencies specify a certain verbal ability the learning activities must reflect this.

Use a Variety of Resources

One of the basic principles of CBE is that students should be given a variety of means by which to learn. In the learning guides you write you should try to use many modes of instruction. This certainly includes the use of various kinds of media. However, for competency-based instruction some forms of media are more suitable than others. The following list gives guidelines for specifying media in your learning guides.

- Supplement readings with cassette audiotapes whenever possible. It is easy for the instructor (or some good oral reader) to make tapes of required readings so students who are poor readers can both see and hear the information.

- Use simple drawings, diagrams, charts, and other graphics on the instruction sheets.

- Slide\tape presentations are excellent for CBE. Students find them easy to use and they can go over any difficult sections as often as they like until they learn. If you select commercially made slide\tape for inclusion in your guide, view them personally to make sure they meet training objectives.

- Use flip charts. Color photographs are printed from the slides and commentary is typed on the mounting page below the photograph as a caption; then the pages are bound with plastic binders. Students seem to like the flip-charts because they can take them right to their work stations. They are a must for hearing impaired students.

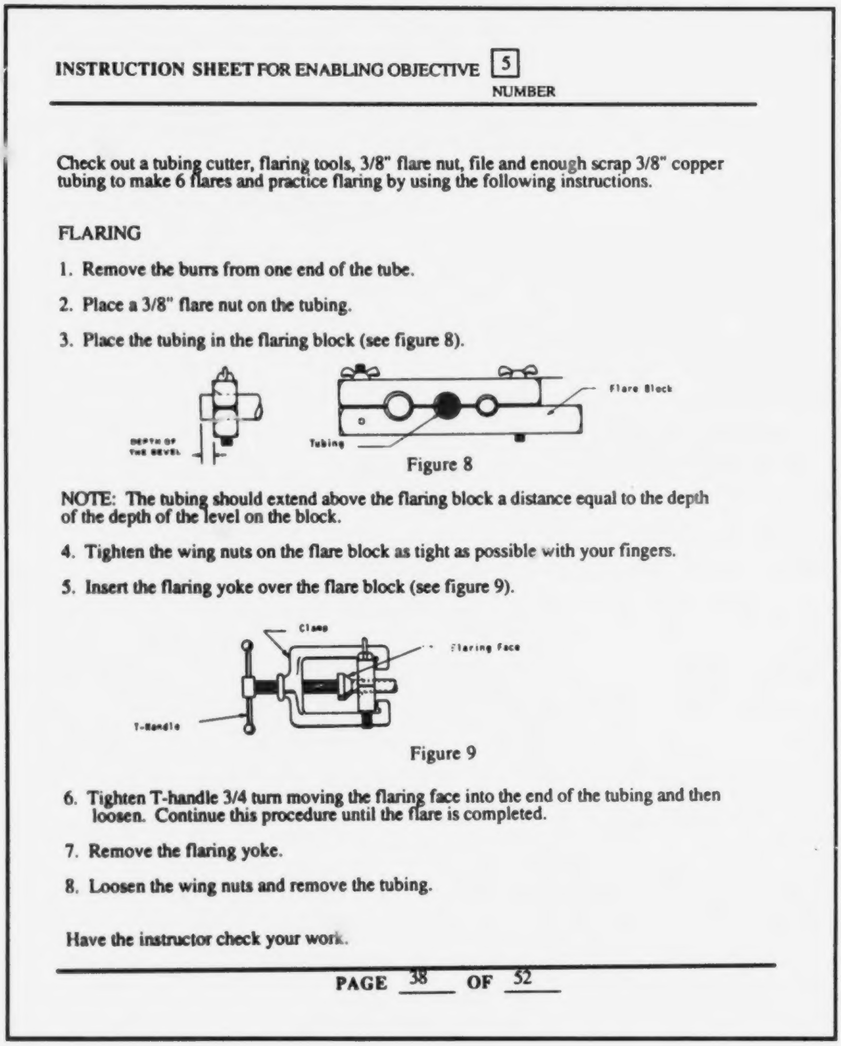
- If overhead transparencies are already available you can still use them in learning guides because the equipment to view transparencies is simple for students to operate. Better still, have the transparencies reproduced on paper as instruction sheets.

- Video cassettes are excellent for CBE when you want to show students a performance or a skill that incorporates movement, video tapes are indispensable. To avoid having the instructor repeat demonstrations constantly, he\she can simply give the demonstration in front of a video camera and make a tape.

- 16 mm films don't work well in CBE. They are best for group-based instruction. Avoid using them as resources in your learning guides if possible. Consider transferring 16mm films to video cassette format (remember copyright laws). 16mm films are difficult to thread.

COMPONENT : Instruction Sheet

Below is a typical Instruction Sheet.



INSTRUCTION SHEET FOR ENABLING OBJECTIVE 5
NUMBER

Check out a tubing cutter, flaring tools, 3/8" flare nut, file and enough scrap 3/8" copper tubing to make 6 flares and practice flaring by using the following instructions.

FLARING

1. Remove the burrs from one end of the tube.
2. Place a 3/8" flare nut on the tubing.
3. Place the tubing in the flaring block (see figure 8).

DEPTH OF THE BEVEL
Flare Block
Tubing

Figure 8

NOTE: The tubing should extend above the flaring block a distance equal to the depth of the depth of the level on the block.

4. Tighten the wing nuts on the flare block as tight as possible with your fingers.
5. Insert the flaring yoke over the flare block (see figure 9).

Figure 9

6. Tighten T-handle 3/4 turn moving the flaring face into the end of the tubing and then loosen. Continue this procedure until the flare is completed.
7. Remove the flaring yoke.
8. Loosen the wing nuts and remove the tubing.

Have the instructor check your work.

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When there are no other appropriate resources to direct the student to, instruction sheets should be used. Remember to indicate which enabling objective is being covered at the top of the instruction sheet in the space provided.

Suggestions for Developing Instruction Sheets

An instruction sheet may be a single sheet, or it may be several pages in length. Some learning guides benefit from having several instruction sheets; other guides will need none. Remember, that a well prepared instruction sheet can be time consuming to develop, so direct students to existing materials whenever possible. You may want to develop instruction sheets if:

- *The information is unusual and not available from any standard source.*
- *The information or data is particularly new and up to date.*
- *The available readings are scattered or written with too much detail.*
- *Available readings are written at the wrong reading comprehension level for the students enrolled in the program.*
- *When students need to refer to instructions frequently in order to complete laboratory work.*
- *Special instructions for projects, learning activities, or laboratory work are needed.*
- *An observation guide or checklist would help the student complete a learning activity effectively.*

All instruction sheets should be carefully designed and prepared. You should know exactly what you are attempting to accomplish with the instruction sheet. All facts, data and technical specifications must be accurate. Spelling, grammar and terminology must be correct. Writing should be at the appropriate level. Drawings, diagrams, sketches and charts should not look crude or amateurish.

COMPONENT:
Self-Checks

SELF-CHECK FOR ENABLING OBJECTIVE 3
NUMBER

DIRECTIONS:

Evaluate your work by answering the following questions on a separate sheet of paper and cut tubing to the specifications outlined in questions 4 and 5. Check out enough tubing to complete this work.

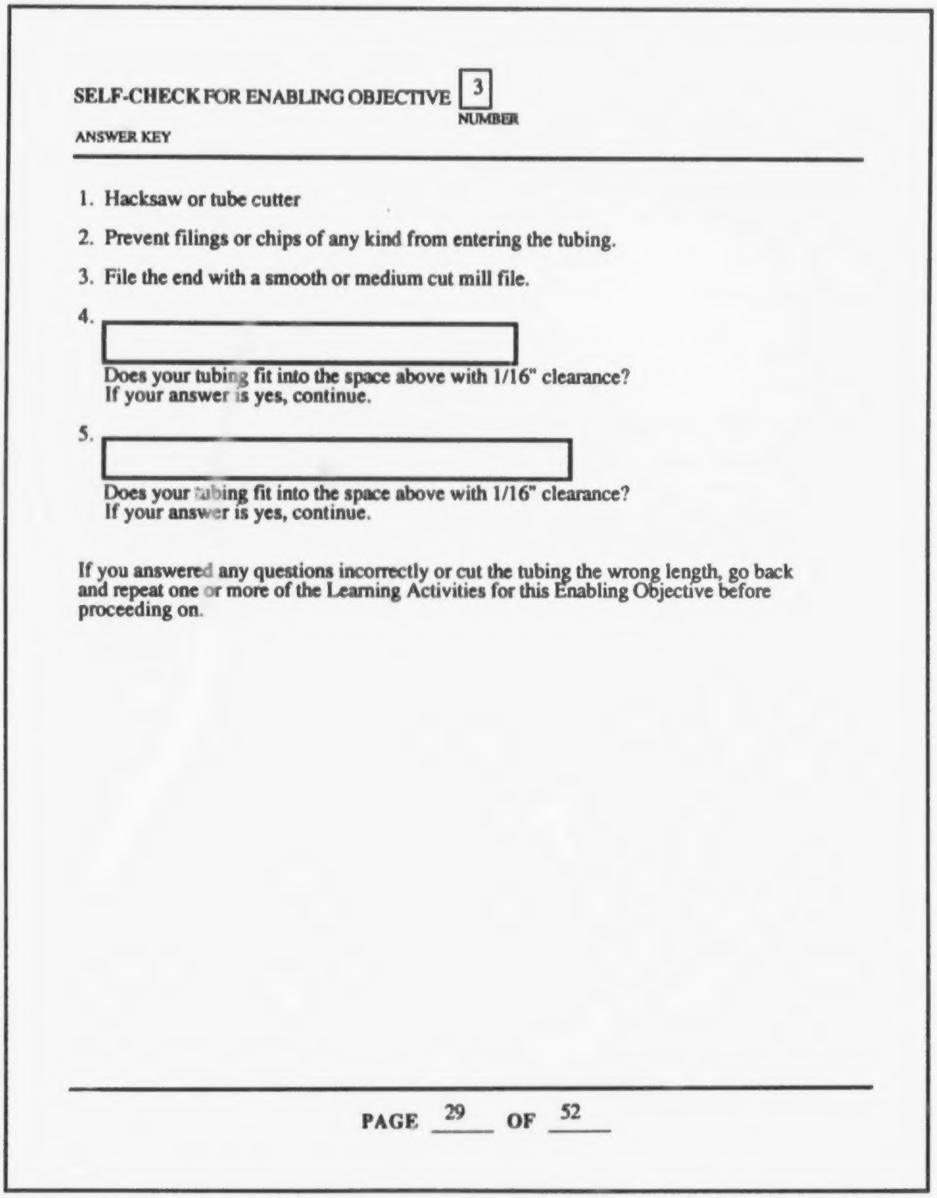
1. What tools are used to cut copper tubing?
2. What precautions should be observed when using cutting tools?
3. How may a full-wall thickness be obtained after cutting a piece of tubing?
4. Cut one piece of 3/8" tubing 3 3/4" long.
5. Cut one piece of 3/8" tubing 4 1/8" long.

Function of Self-Check

Description: If the E.O. for the learning guide involved knowledge enabling objectives (E.O.), the Self-Check can be used as a means of having the student PRACTICE or APPLY what was presented for that E.O. By answering questions, solving problems, drawing schematics, etc., the student is applying the knowledge taught by a book, slide, instruction sheet or other resource. Then by comparing answers or work to an Answer Key (or having the instructor review it), the students get FEEDBACK on that practice. If the E.O. involves a hands-on skill, the student will be told in the learning activities section to PRACTICE that skill. The self-check is then used as a means of helping the student get immediate FEEDBACK on the success of that practice. There should be at least one Self-Check (in some cases two if both knowledge and performance are involved) for each enabling objective. A self check is an informal test that basically tells a student whether or not he or she is ready to move on to the next enabling objective. The function of a self check is to provide the student with immediate feedback.

COMPONENT: Self-Check Answer Key

If appropriate, include a self-check answer key in the learning guide. Stress the importance to the student of not "peeking" ahead at the answers.



SELF-CHECK FOR ENABLING OBJECTIVE 3
NUMBER

ANSWER KEY

1. Hacksaw or tube cutter
2. Prevent filings or chips of any kind from entering the tubing.
3. File the end with a smooth or medium cut mill file.
4. Does your tubing fit into the space above with 1/16" clearance? If your answer is yes, continue.
5. Does your tubing fit into the space above with 1/16" clearance? If your answer is yes, continue.

If you answered any questions incorrectly or cut the tubing the wrong length, go back and repeat one or more of the Learning Activities for this Enabling Objective before proceeding on.

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Suggestions: Self-Checks for Performance.

1. Include self-checks for performance in the learning guide if enabling objective is performance oriented.

2. If there are checklists, rating scales etc. in textbooks or workbooks, these can be used instead of self-checks. Direct the student to the appropriate source in the resource column of the learning activities page.

3. Include enough detail in directions telling the student how to use the self-check.

4. Since the student will be performing part of a procedure or producing something and then checking his or her own performance or another student's performance, the self-check criteria must be complete and objective enough to be able to distinguish between correct and incorrect practice. Look at the checklist items below:

1. Were all wires trimmed properly?
2. Were head bolts tightened correctly?
3. Was enough cement used?

The student may be conscientious in checking his or her work and yet may check "yes" to these when, in fact, his performance was incorrect. The above three items do not give the student enough specific information upon which to base the decision to answer "yes" or "no". Look at these same items reworded:

1. Were all wires trimmed off 1/2" of insulation leaving no nicks on the wire?
2. Were head bolts tightened gradually to 25 ft. lbs. of torque?
3. Was enough cement used to completely cover the entire joint?

Make sure the self-check criteria is complete and that whatever "correctly" or "properly" is, is spelled out in detail.

5. You may want to require one student to use the self-check and rate another student's performance. This encourages student interaction.

6. You may want to have students check their own work and then have them bring the finished product to you for evaluation.

Knowledge Self-Checks

Occasionally you may teach a lot of knowledge and a skill for one enabling objective. You may need a Self-Check (questions, etc.) for the knowledge taught, then require hands-on practice of the skill taught and then use a second Self-Check to give feedback on that practice.

Suggestion: Self-Checks for Knowledge (to provide application of learning):

1. If possible use objective type questions: Multiple-choice, true-false, matching, short answer, fill in the blank etc. These types of questions are easier to grade and are not open to subjectivity.

2. Be sure to include detailed directions telling the student exactly what to do to complete the Self-Check.

3. If you can find good study questions, review exercises etc. in books or other resources, those can be used instead of a Self-Check.

4. Tell the student (on the learning activities page) what to do to check his\her answers or work.

5. You may want to include the Answer Key right in the learning guide.

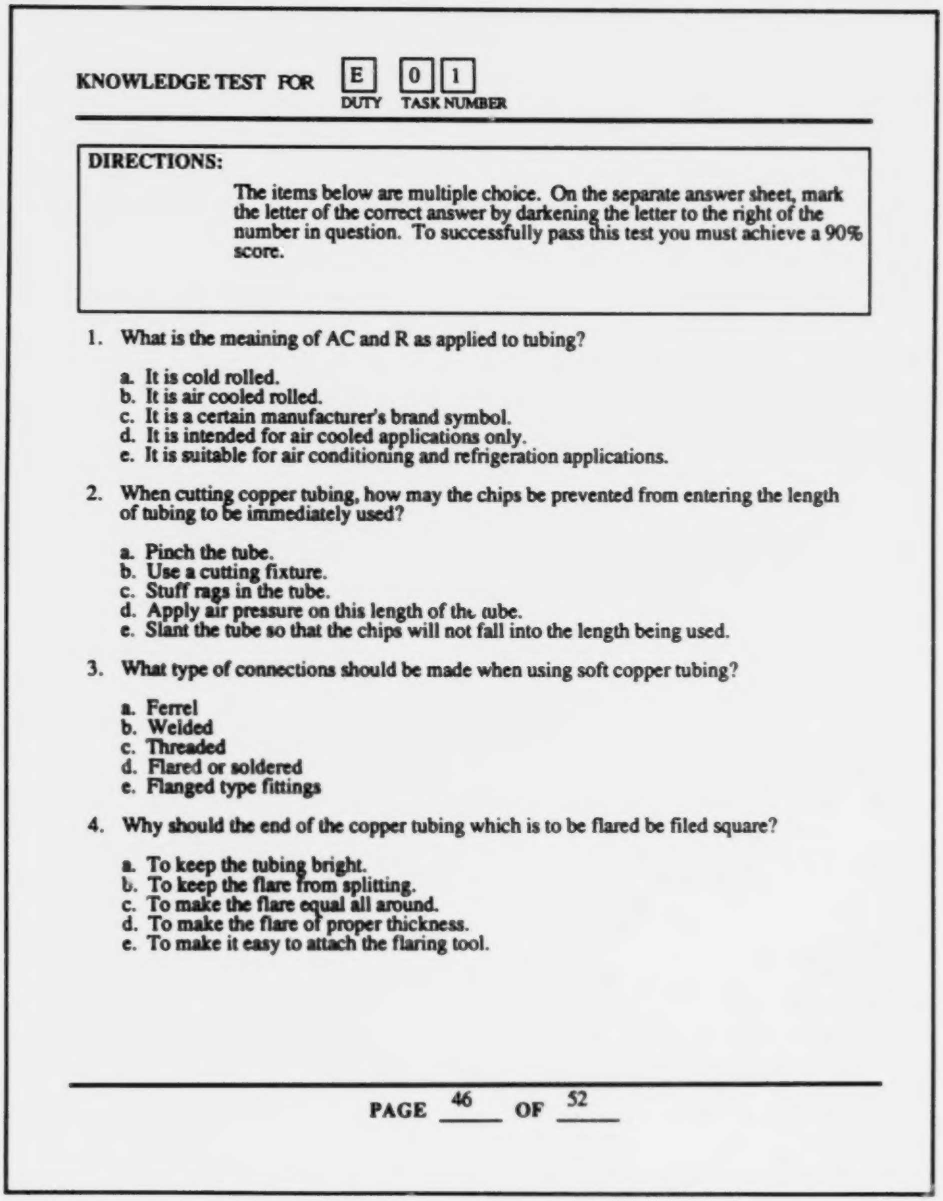
6. If not included in the guide, you may want to direct the student to the file cabinet, or instructor for the Answer Key.

7. Sometimes you will want to direct a student to the instructor to check answers rather than use an Answer Key. Other times you may want to have the student use the Answer Key and check with the instructor if additional information is needed.

When the Enabling Objective Involves:	Have the Student Practice or Apply What Was Presented By:	Give the Student Feedback By:
Knowledge	Actually completing the self-check (questions, problems, etc.)	Comparing answers to Answer Key and/or instructor
Skill	Learning activities page telling student to practice the skill	Comparing performance to criteria listed on a Self-Check

COMPONENT: The Knowledge Test

Now we will examine the Knowledge Test which appears below. The Knowledge Test is not physically contained in the learning package but is kept in a secure area. Most learning guides will contain a Performance Test. Only include Knowledge Tests if they are essential for evaluating mastery of the competency.



KNOWLEDGE TEST FOR E 0 1
DUTY TASK NUMBER

DIRECTIONS:

The items below are multiple choice. On the separate answer sheet, mark the letter of the correct answer by darkening the letter to the right of the number in question. To successfully pass this test you must achieve a 90% score.

1. What is the meaining of AC and R as applied to tubing?
   a. It is cold rolled.
   b. It is air cooled rolled.
   c. It is a certain manufacturer's brand symbol.
   d. It is intended for air cooled applications only.
   e. It is suitable for air conditioning and refrigeration applications.

2. When cutting copper tubing, how may the chips be prevented from entering the length of tubing to be immediately used?
   a. Pinch the tube.
   b. Use a cutting fixture.
   c. Stuff rags in the tube.
   d. Apply air pressure on this length of the tube.
   e. Slant the tube so that the chips will not fall into the length being used.

3. What type of connections should be made when using soft copper tubing?
   a. Ferrel
   b. Welded
   c. Threaded
   d. Flared or soldered
   e. Flanged type fittings

4. Why should the end of the copper tubing which is to be flared be filed square?
   a. To keep the tubing bright.
   b. To keep the flare from splitting.
   c. To make the flare equal all around.
   d. To make the flare of proper thickness.
   e. To make it easy to attach the flaring tool.

PAGE 46 **OF** 52

Knowledge Test

Description: The directions tell the student what the test covers, how to respond to the items, how many questions must be answered correctly for mastery, any time limit imposed and any other information needed.

DIRECTIONS:

The items below are multiple choice. On the separate answer sheet, mark the letter of the correct answer by darkening the letter to the right of the number in question. To successfully pass this test you must achieve a 90% score.

Suggestions: Knowledge Tests

Use Multiple Choice Tests

It is recommended that whenever possible multiple choice questions be used on knowledge tests for the following reasons:

1. There is only one correct answer reducing the chances of student complaints regarding correct answers and objective grading.

2. Multiple-choice tests are easy for students to take.

3. Multiple-choice tests are easy to score.

Remember the following suggestions when designing a knowledge test using multiple choice questions.

A. The stem should include a complete thought, and may be a question, phrase or statement.

B. Include only one main thought in the stems.

C. Don't end a stem with "a" or "an".

D. Punctuate the stem correctly.

E. Make sure there is only one correct answer.

F. Make sure all the alternatives are plausible choices.

G. Include four or five alternatives.

H. Avoid using "all the above", "none of the above", "A and B", etc. if possible.

I. Make alternatives similar in point of view and length.

- -

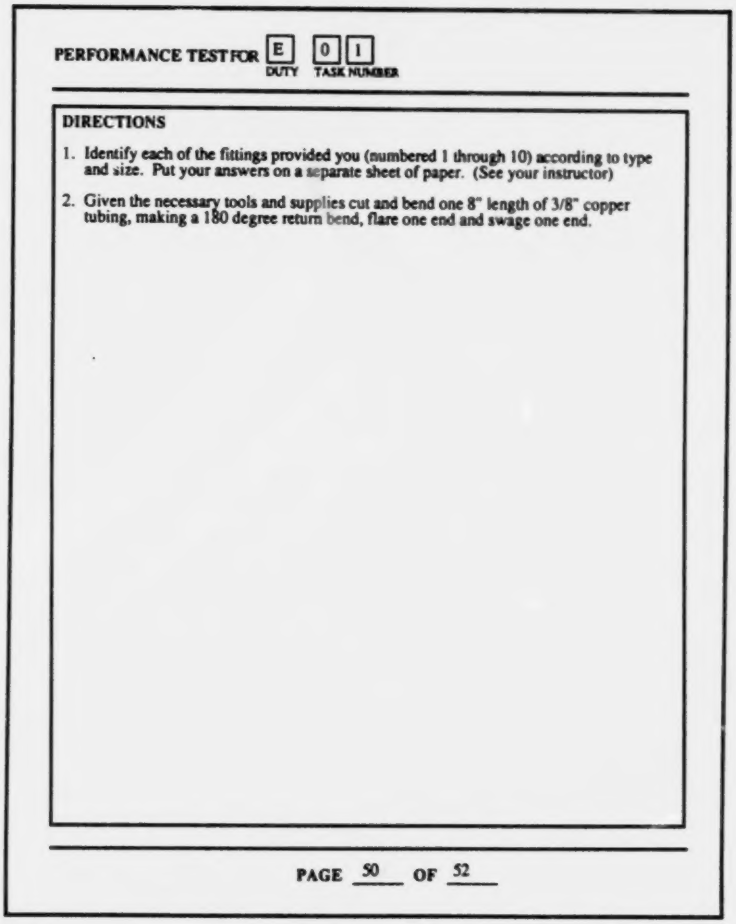
4. If at all possible, it is also recommended that the number of questions on the knowledge test be evenly divisible into 100 for ease of scoring.

5. If cheating becomes a problem on knowledge tests, instructors should consider developing a test bank where there are several alternative questions or simply change the order of questions.

COMPONENT: Performance Tests

The only way to be confident that your students have mastered the tasks in your program is to have them actually perform each task at a high level of mastery. Since most of the tasks in a vocational technical program will be skill oriented most learning guides will include a performance test.

Remember, requiring each trainee to demonstrate mastery of each task is probably the single most significant difference between the competency-based and the more traditional approach to vocational education. The TSTI-Amarillo student learning guide format contains two pages for administering a performance test: Directions and Performance Standards. The Directions page appears below and a sample of the Performance Standards page appears on the next page.



PERFORMANCE TEST FOR E 0 1

DUTY TASK NUMBER

DIRECTIONS

1. Identify each of the fittings provided you (numbered 1 through 10) according to type and size. Put your answers on a separate sheet of paper. (See your instructor)
2. Given the necessary tools and supplies cut and bend one 8" length of 3/8" copper tubing, making a 180 degree return bend, flare one end and swage one end.

PAGE 50 OF 52

PERFORMANCE TEST FOR E duty O 1 task number
CONTINUED

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Did the student identify all the fittings correctly?		
2. Are the length of the legs equal?		
3. The tubing is not flattened or kinked?		
4. Is the flare equal all around?		
5. Is the flare of the proper depth?		
6. Is the flare smooth and not split on the end?		
7. Was the flare properly deburred, in that it has no inside ridge?		
8. Is the flare nut installed properly?		
9. Is the swage the proper depth?		
10. Will another piece of 3/8" tubing fit into the swage?		

PAGE________OF________

Performance Standards

Directions

Suggestions: Performance Test (Directions)

1. Are the directions clear and concise?
2. Is the purpose of the test mentioned?
3. Is the testing situation described for the student?
4. Is the student told exactly what to do?
5. Are any special restrictions mentioned?
6. Is a time limit mentioned?

Standards

Suggestions: Performance Test (Standards)

1. Is each item objective and observable?
2. Can each item be rated "yes" or "no"?
3. Are subjective words such as "good" and "well" avoided?
4. Is only one step included per item?
5. Are items listed in the order they occur?
6. Are only critical characteristics of the finished product included?
7. Are criteria for acceptability spelled out (precise dimensions, tolerances etc.)?
8. Are items written at a high enough level to ensure the job competence of those passing tests?

Both knowledge and performance tests are covered in greater detail in Section C-2 and C-3 of this component.

COMPONENT:
List of
Resources

LIST OF RESOURCES

INSTRUCTIONAL RESOURCES

TEXT

Although, Adrew D., Turnquist, Carl H., and Bracciano, Alfred F., Modern Refrigeration and Air Conditioning, Goodheart-Wilcox Co., Inc. South Holland, Illinois, 1982.

AUDIOVISUAL

"Cutting Tubing", Video Tape, TSTI-Amarillo

"Bending Copper Tubing", Video Tape, TSTI-Amarillo

"Flaring Copper Tubing", Video Tape, TSTI-Amarillo

"Swaging Copper Tubing", Video Tape, TSTI-Amarillo

TRAINING AIDS

"Fitting Display Board", TSTI-Amarillo

Competency-Based Education in a Traditional Delivery Setting

A "traditional" or "conventional" delivery system is usually characterized by four factors:

1. **limited enrollment dates** (quarter, semester)
2. **group oriented** (an entire group, class) of students move from topic to topic
3. **course oriented** (subject matter is organized around courses)
4. **instructor centered** (the instructor delivers most or all of the instruction).

The authors of the Resource Guide realize that this is a rather simplified definition of a traditional delivery system but for discussion purposes it will serve as a starting point since most (not all) technical and vocational programs in Texas:

1. have limited enrollment dates
2. are group oriented
3. are course structured
4. rely on the instructor to deliver most of the instruction

CBE is Possible in a Traditional Delivery System

Is competency-based education possible in a traditional course based delivery system? The answer to this question is definitely "Yes!". Remember, throughout the Resource Guide we have identified only three factors that are essential to competency-based education. Once again they are:

1. A CBE program is based on clearly stated industry validated competencies.

2. Instruction is delivered to the extent practical in a manner that maximizes learning outcomes for each student.

3. Students are evaluated on their ability to demonstrate mastery of the competencies.

If the above three essential factors are met, then a training program can call itself competency-based. Factor #1 is fairly objective and it is a simple matter to ascertain if a training program is based on industry validated competencies. Factor #1 requires a "Yes" answer to all of the questions listed below:

Is Program Task Based

	yes	no
1. Is the training program based on the actual skills (tasks) performed on the job as verified by business and industry?	√	
2. Are these tasks specific, objective and stated in writing? (Official program task listing.)	√	
3. Is this task listing updated periodically to assure that training remains current?	√	
4. Is a task list given to all students as they enroll in the program?	√	

If any of the above questions receive a "No" response then a training program is not competency-based.

Mastery Evaluation

The second factor (#3 on the list of essential elements-CBE evaluates students on their ability to demonstrate mastery of the competencies) is also simple to measure. Once again all of the following questions should be answered "Yes".

	yes	no
1. Is each individual student required to actually demonstrate mastery of each competency in a job-like setting?	√	
2. Are tests valid for the tasks? (Are performance tests used to test performance skills)	√	
3. Is mastery of each task defined and is mastery defined at job-entry level? (specific criteria is listed)	√	
4. Are grades based solely on mastery of competencies? (no weighting or norm referencing)	√	

If any of the above questions receives a "No" then the training program is not competency-based.

A validated task listing and appropriate methods of evaluation based on mastery of tasks contained in the task listing are necessary to assure that a program using a traditional delivery system is competency-based. **If these factors are not in place then it is impossible for a training program to be competency-based, no matter what the instructional delivery system is.**

Role of Instruction

In competency-based education instructional delivery has only one role: to provide learners with the knowledge, skills and attitudes to demonstrate mastery of tasks that have been validated by business and industry as necessary for entry level employment in a specific occupation. The preceding statement involves three factors; tasks, instruction and evaluation. Two of the factors are constant while one can be considered a variable. Both "tasks" and "evaluation" are considered constant. Tasks are based on specified skills verified by business and industry. Evaluation is based on a pre-determined mastery level. "Instruction" is the only variable of the three essential elements because a variety of instructional delivery methods can be used as long as they are based on validated tasks and evaluation of students is based on mastery performance.

Competency-based education is possible in a traditional or conventional delivery system only if instruction is based on clearly stated industry validated competencies and students are evaluated on their ability to demonstrate mastery of competencies.

Most vocational technical training programs at the post-secondary level are structured on courses. Students enroll in a program, sign up for specific courses and once they have passed a pre-determined amount of courses they receive a certificate or a degree. Competency-based education can and has worked successfully in a course structured environment. Since most schools in Texas base instruction on courses, the logical starting point for developing competency-based programs is at the course level.

Most schools require instructors to develop a syllabus for each course taught. Course syllabi vary from institution to institution but usually include a description of the course, a sequence of topics to be covered, often contain a grading policy and usually list text books or other resources that are required. Assuming a validated task listing has already been developed; revising or designing a syllabus format that is based on industry validated tasks is often the first step that a training program using the traditional delivery system might take in implementing competency-based education.

The following sample of a course syllabus format was developed at TSTI-Amarillo. An explanation of each section follows the sample. Blank course syllabus forms are located in Component E of the Resource Guide.

TSTI AMARILLO

Course Syllabus

Course Number: CAA 122

Course Title: Survey of Reproduction Processes

Date: May 4, 1987

Prepared by: Karen R. Atkins

This syllabus has been reviewed and is current on the date indicated:

APPROVED	DATE

TSTI AMARILLO
Course Syllabus

1. Course Objective-The catalog description of the course

Introduction theory to printing processes, make-ready for printing, and paper selection.

II. Task Inventory-List the tasks from the task listing which are covered by this course.

Duty D-STUDYING PRINT REPRODUCTION PROCESSES

01 Describe printing processes.

02 Identify make-ready processes.

03 Identify special printing effects.

04 Specify folding and binding and make folder mock-ups.

05 Select and specify printing papers.

III. A. Performance Objectives

Duty D

Task 01 Given specific printing assignments and access to the appropriate resources, the student will select and describe the most appropriate process for each job, completing a knowledge test with 90% accuracy.

Task 02 Given access to appropriate resources as well as examples, the student will describe the steps necessary for make-ready of artwork in offset lithography printing, completing a knowledge test with 90% accuracy.

Task 03 Given information on special printing effects, printed examples and text sources, the student will examine the available resources, select an appropriate effect to enhance the communication and, select the reproduction process appropriate to each effect, completing a knowledge test with 90% accuracy.

Task 04 Given access to appropriate text as well as examples, the student will demonstrate the folding process and specify binding, completing both a performance test (100% accuracy) and a knowledge test (90% accuracy).

Task 05 Given access to the appropriate text references and paper samples, the student will select and specify printing papers, completing a knowledge test with 90% accuracy.

III. B. Content Outline (optional if learning guides are in use)

IV. Grading Procedure

Survey of Reproduction Processes consists of 5 tasks. Completion of each task constitutes 20% of the final grade. Task 4, consisting of both a performance and a knowledge test, will have the two tests averaged together to achieve the 20%. For successful completion of the course, the student must achieve 90% on all knowledge tests plus100% on the performance test. Failure to achieve 90%/100% will require that the student attempt the task again until the proper score is achieved.

V. Student References (texts, reference books, any other references the student will be expected to use). (If course is competency-based, list learning guides only.)

Student Learning Guides

DUTY V- Task 01 Describe printing processes
Task 02 Identify make-ready processes
Task 03 Identify special printing effects
Task 04 Specify folding and binding and make folder mock-ups
Task 05 Select and specify printing papers.

The course syllabus you have just reviewed is based on a format developed at Texas State Technical Institute Amarillo and can be used in training programs that utilize either student learning guides or more traditional delivery methods. The major difference between this syllabus format and others that are commonly used is that it is task based. Remember, competency-based education is based on industry validated tasks. The next several pages will contain directions on how to fill out the TSTI syllabus format. Blank syllabus forms are included in Component E of the Resource Guide.

TSTI AMARILLO
Course Syllabus

Course Number: ***Official Course Number***

Course Title: ***Official Course Title, Credits, Hours***

Date: ***Date Syllabus Completed***

Prepared by: ***Name of individual(s) responsible for preparing syllabus***

This syllabus has been reviewed and is current on the date indicated:

APPROVED	DATE
This space is for approval signatures. Most training programs would require approval by the department chairperson and usually a curriculum coordinator or other designated administrator.	***Date approved.***

TSTI AMARILLO
Course Syllabus

1. Course Objective- Catalog description of the course

The latest official course description should be written in this space.

II. Task Inventory-List the tasks from the task listing which are covered by this course

Competency-based vocational and technical programs should only have students learn skills that have been validated by business and industry as necessary for successful employment in a particular occupation. In this space list tasks that will be taught in the course, using the exact numbering system and wording from the program's official task listing.

III. A. Performance Objectives

A performance objective describes what students are able to do at the completion of the unit, what knowledge they possess, what skills they will be able to perform, and what affective skills they will have. Objectives should be stated in performance terms and include the following components: a performance, a condition and a criterion component. There should only be one objective per unit or task. If you list ten tasks or units then you must list ten performance objectives

If your program is using student learning guides each performance objective will be the same as the performance objective listed in the student learning guide. If there are five learning guides in the course then there will be five performance objectives.

III. B. Content Outline (optional if learning guides are in use)

Use Roman numerals for each unit and a capital letter for each subunit. Normally units are listed in the order they are to be covered. The sample syllabus did not contain any information on this page since student learning guides were used.

Dates that specific units will be covered can also be included on this page.

Units should correspond to tasks.

IV. Grading Procedure

This section describes in detail the grading policies for the course. Any rules involving tardiness, absence or discipline should be covered here. Be as specific as possible describing the grading standards, what percentage of the grade is based on lab work, what percentage is based on written exams, number of tests, etc. Rules and regulations of the classroom and shop should also be explained. If your department has an overall program policy that is used for all courses, make reference to that policy in this space. This section has to be as objective as possible giving the student the exact criteria his or her grade will be based on.

V. Student References (texts, reference books, any other references the student will be expected to use). (If competency-based, list learning guides only.)

List references that are to be used by the student on an ongoing basis in the course. Also list any specialized tools, supplies or materials the student will be expected to purchase for the course. Many programs provide the student with a book, supply and materials list. If your program does this, please make reference to the list in this section.

(If course uses student learning guides, the letter and number on the left side of task will indicate the learning guide number.)

How A Course Syllabus Can Support Essential Elements of CBE	
Element	**How It Supports CBE**
Task Inventory (see page 321)	Remember CBE is based on specified tasks validated by business and industry. By listing the tasks to be covered in the course, instruction can then be designed with these tasks in mind. Students are informed of exactly what they must learn.
Performance Objective (see page 322)	A performance objective is included for each task that will be covered in the course. The performance objective tells the student what he or she must be able to do to complete the task.
Grading Procedure (see page 324)	Tells the student how she or he will be evaluated.

Once the course syllabus has been developed it serves as the framework for instruction. The following list contains suggestions that should be considered by instructors as they develop course syllabi.

Suggestions

√ 1. Base content of the course on tasks from your task listing.

√ 2. Use a variety of resources. Many instructors are "guilty" of selecting one textbook and then basing the contents of the course on the chapters of the textbook which may or may not be correlated to the program's task listing.

√ 3. The length of the course (credit hours) should be determined by the actual time it takes to learn a task (or tasks). Many courses have an "artificial" length based on three credit hours.

√ 4. Do not separate theory (knowledge) and skills. Teach theory at the time when students are learning to perform the skill.

√ 5. Make sure evaluation (testing) is based on successful performance of tasks.

Once a course syllabus has been developed, the next step in the process is the actual delivery of instruction. It is highly recommended that instructors in a traditional delivery system use some type of lesson plan. Remember, CBE is based on tasks (fixed content). A written lesson plan can keep instructors on track and insure that specific competencies are covered. Lesson plans are for the use of instructors and are normally not given to students. The authors of this publication strongly recommend the use of student learning guides for the delivery of competency-based education but realize that many training programs are group oriented and recommend the following publication as a source of information for developing lesson plans:

B-4 Develop a Lesson Plan (part of the Performance-Based Teacher Education Modules available from the American Association for Vocational Instructional Materials, 120 Engineering Center, University of Georgia, Athens, Georgia 30602, (404)-542-2586)

Suggestions for Instructional Delivery in Group Oriented Training Programs

1. Make sure instructional content is based on tasks.

2. Reduce the time spent on lectures and integrate lectures with hands-on activities.

3. Make sure that performance (hands-on) skills are evaluated by performance tests and not knowledge tests.

4. Provide students with a program task listing.

5. Establish high levels of mastery.

6. Provide frequent and immediate feedback.

7. Provide alternative learning activities for students who are having problems. (Peer tutoring, etc.)

8. Base final grades on successful demonstration of competencies at a high level of mastery and not upon averages and/or grading curves.

9. Only teach essential knowledge and skills.

10. Use audio visual presentations if appropriate.

11. Allow students to practice skills before evaluation.

Component C Resource Listing

Each component of this manual includes a resource section. Resource Section C-contains information on task analysis and student learning guides.

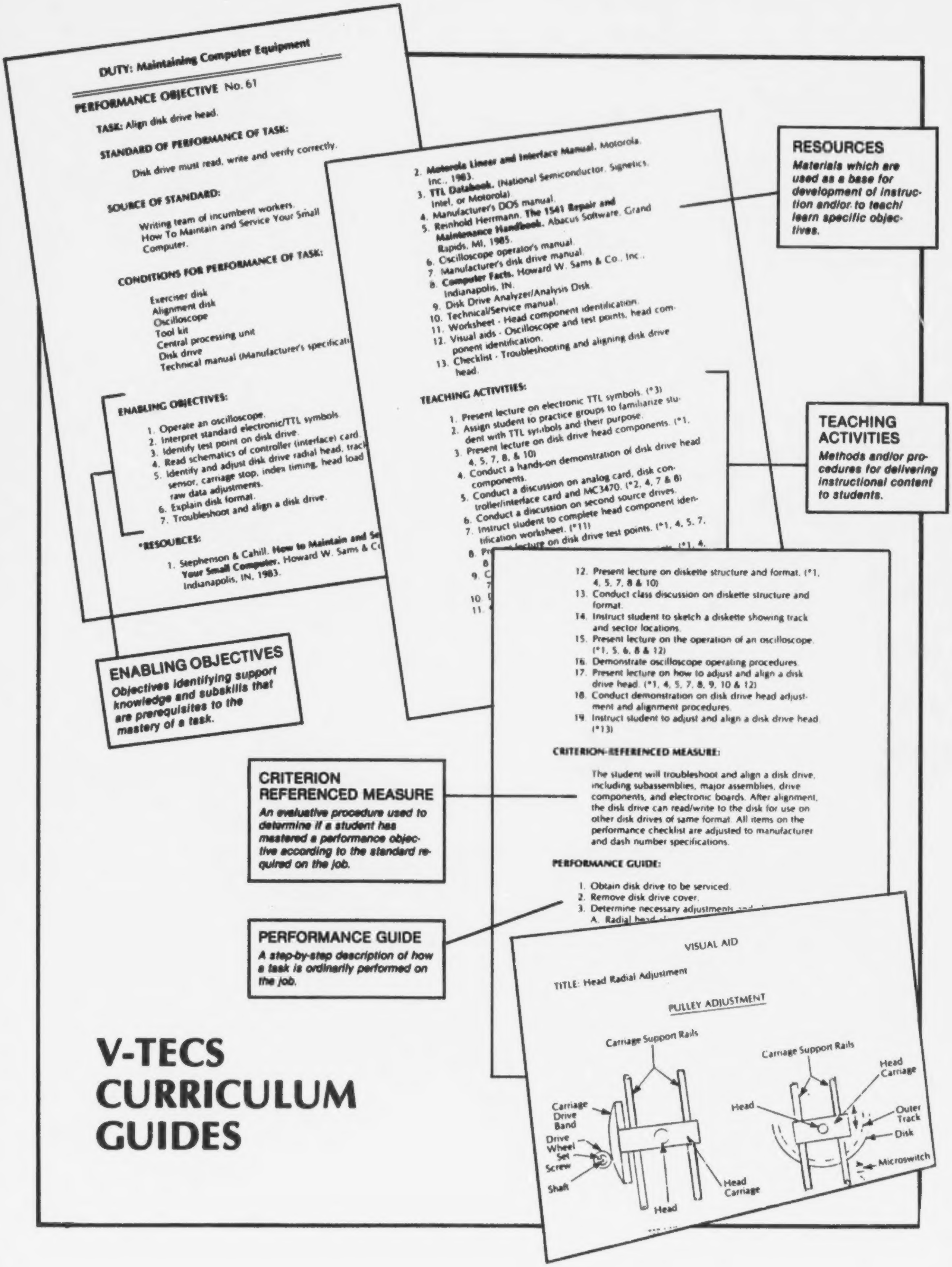
Table of Contents

V-TECS	**(335-339)**
Task Analysis Form	**(340-341)**
Sample Student Learning Guides	**(342-377)**

V-TECS
(Vocational Technical Education Consortium of States)

The purpose of V-TECS is to promote the systematic development and implementation of the concept of competency-based education. V-TECS produces catalogs of performance objectives, curriculum guides and criterion referenced test items. The following resource is a copy of a V-TECS brochure. Additional information can be obtained by contacting:

Vocational Technical Education Consortium of States
Commission on Occupational Education Institutions
Southern Association of Colleges and Schools
795 Peachtree N.E.
Atlanta, Georgia 30365
404-897-6158



DUTY: Maintaining Computer Equipment

PERFORMANCE OBJECTIVE No. 61

TASK: Align disk drive head.

STANDARD OF PERFORMANCE OF TASK:

Disk drive must read, write and verify correctly.

SOURCE OF STANDARD:

Writing team of incumbent workers.
How To Maintain and Service Your Small Computer.

CONDITIONS FOR PERFORMANCE OF TASK:

Exerciser disk
Alignment disk
Oscilloscope
Tool kit
Central processing unit
Disk drive
Technical manual (Manufacturer's specificati

ENABLING OBJECTIVES:

1. Operate an oscilloscope.
2. Interpret standard electronic/TTL symbols.
3. Identify test point on disk drive.
4. Read schematics of controller (interface) card.
5. Identify and adjust disk drive radial head, track sensor, carriage stop, index timing, head load raw data adjustments.
6. Explain disk format.
7. Troubleshoot and align a disk drive.

***RESOURCES:**

1. Stephenson & Cahill. **How to Maintain and Se Your Small Computer.** Howard W. Sams & C Indianapolis, IN, 1983.
2. **Motorola Linear and Interface Manual.** Motorola, Inc., 1983.
3. **TTL Databook.** (National Semiconductor, Signetics, Intel, or Motorola)
4. Manufacturer's DOS manual.
5. Reinhold Herrmann. **The 1541 Repair and Maintenance Handbook.** Abacus Software, Grand Rapids, MI, 1985.
6. Oscilloscope operator's manual.
7. Manufacturer's disk drive manual.
8. **Computer Facts.** Howard W. Sams & Co., Inc., Indianapolis, IN.
9. Disk Drive Analyzer/Analysis Disk.
10. Technical/Service manual.
11. Worksheet - Head component identification.
12. Visual aids - Oscilloscope and test points, head component identification.
13. Checklist - Troubleshooting and aligning disk drive head.

TEACHING ACTIVITIES:

1. Present lecture on electronic TTL symbols. (*3)
2. Assign student to practice groups to familiarize student with TTL symbols and their purpose.
3. Present lecture on disk drive head components. (*1, 4, 5, 7, 8, & 10)
4. Conduct a hands-on demonstration of disk drive head components.
5. Conduct a discussion on analog card, disk controller/interface card and MC3470. (*2, 4, 7 & 8)
6. Conduct a discussion on second source drives.
7. Instruct student to complete head component identification worksheet. (*11)
8. Pr lecture on disk drive test points. (*1, 4, 5, 7, 8 (*1, 4,
9. C 7
10.
11.

12. Present lecture on diskette structure and format. (*1, 4, 5, 7, 8 & 10)
13. Conduct class discussion on diskette structure and format.
14. Instruct student to sketch a diskette showing track and sector locations.
15. Present lecture on the operation of an oscilloscope. (*1, 5, 6, 8 & 12)
16. Demonstrate oscilloscope operating procedures.
17. Present lecture on how to adjust and align a disk drive head. (*1, 4, 5, 7, 8, 9, 10 & 12)
18. Conduct demonstration on disk drive head adjustment and alignment procedures.
19. Instruct student to adjust and align a disk drive head. (*13)

CRITERION-REFERENCED MEASURE:

The student will troubleshoot and align a disk drive, including subassemblies, major assemblies, drive components, and electronic boards. After alignment, the disk drive can read/write to the disk for use on other disk drives of same format. All items on the performance checklist are adjusted to manufacturer and dash number specifications.

PERFORMANCE GUIDE:

1. Obtain disk drive to be serviced.
2. Remove disk drive cover.
3. Determine necessary adjustments
   A. Radial head

VISUAL AID

TITLE: Head Radial Adjustment

PULLEY ADJUSTMENT

RESOURCES
Materials which are used as a base for development of instruction and/or to teach/learn specific objectives.

TEACHING ACTIVITIES
Methods and/or procedures for delivering instructional content to students.

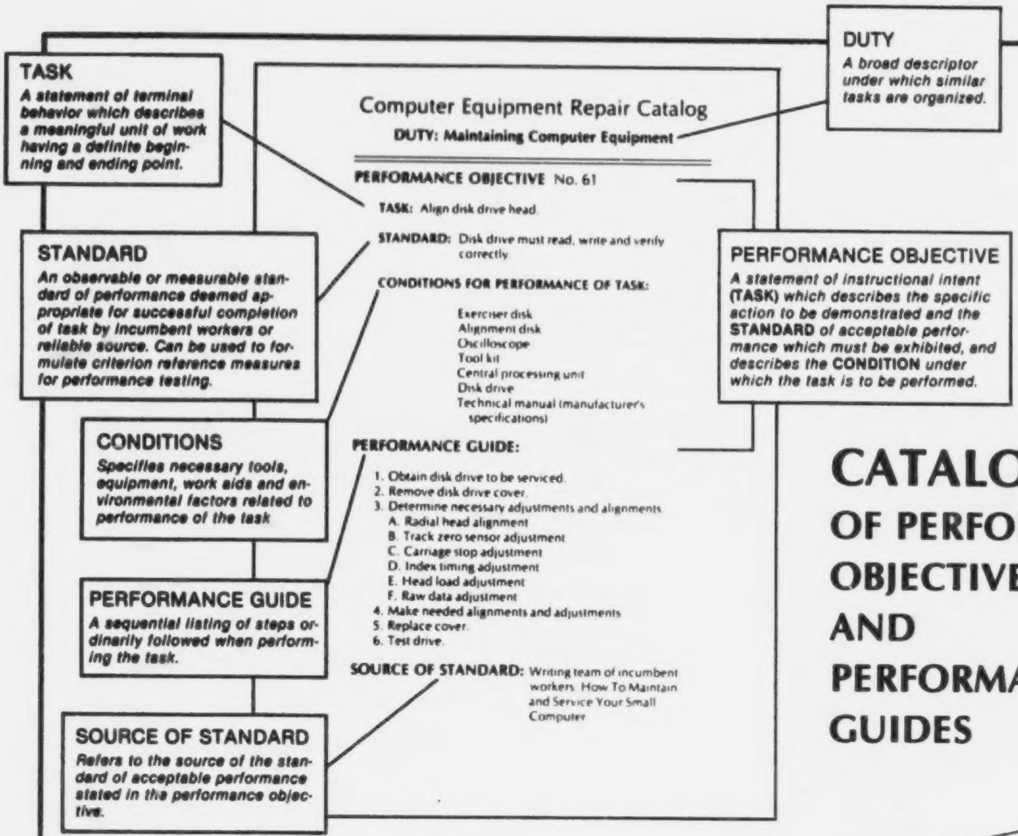
ENABLING OBJECTIVES
Objectives identifying support knowledge and subskills that are prerequisites to the mastery of a task.

CRITERION REFERENCED MEASURE
An evaluative procedure used to determine if a student has mastered a performance objective according to the standard required on the job.

PERFORMANCE GUIDE
A step-by-step description of how a task is ordinarily performed on the job.

V-TECS CURRICULUM GUIDES

CATALOGS
OF PERFORMANCE OBJECTIVES AND PERFORMANCE GUIDES



TASK
A statement of terminal behavior which describes a meaningful unit of work having a definite beginning and ending point.

STANDARD
An observable or measurable standard of performance deemed appropriate for successful completion of task by incumbent workers or reliable source. Can be used to formulate criterion reference measures for performance testing.

CONDITIONS
Specifies necessary tools, equipment, work aids and environmental factors related to performance of the task

PERFORMANCE GUIDE
A sequential listing of steps ordinarily followed when performing the task.

SOURCE OF STANDARD
Refers to the source of the standard of acceptable performance stated in the performance objective.

DUTY
A broad descriptor under which similar tasks are organized.

PERFORMANCE OBJECTIVE
A statement of instructional intent ***(TASK)*** *which describes the specific action to be demonstrated and the* ***STANDARD*** *of acceptable performance which must be exhibited, and describes the* ***CONDITION*** *under which the task is to be performed.*

Computer Equipment Repair Catalog

DUTY: Maintaining Computer Equipment

PERFORMANCE OBJECTIVE No. 61

TASK: Align disk drive head.

STANDARD: Disk drive must read, write and verify correctly.

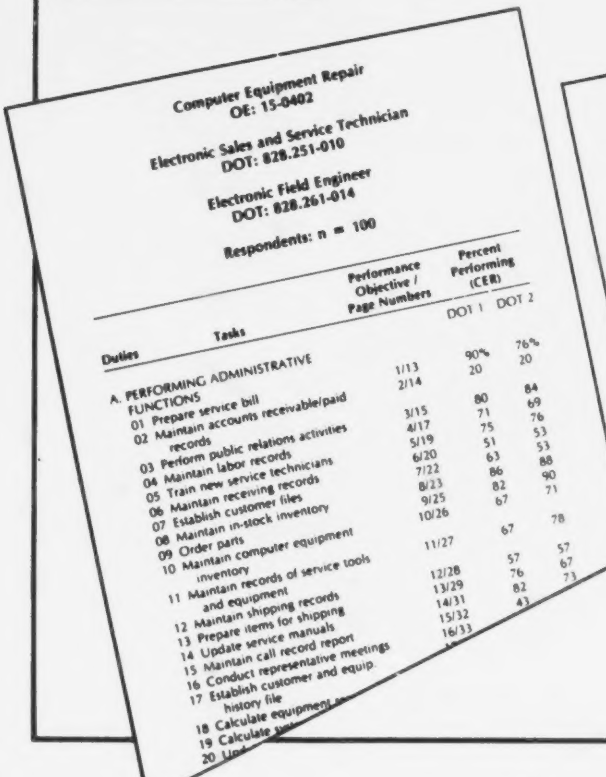
CONDITIONS FOR PERFORMANCE OF TASK:

- Exerciser disk
- Alignment disk
- Oscilloscope
- Tool kit
- Central processing unit
- Disk drive
- Technical manual (manufacturer's specifications)

PERFORMANCE GUIDE:

1. Obtain disk drive to be serviced.
2. Remove disk drive cover.
3. Determine necessary adjustments and alignments.
   - A. Radial head alignment
   - B. Track zero sensor adjustment
   - C. Carriage stop adjustment
   - D. Index timing adjustment
   - E. Head load adjustment
   - F. Raw data adjustment
4. Make needed alignments and adjustments.
5. Replace cover.
6. Test drive.

SOURCE OF STANDARD: Writing team of incumbent workers. How To Maintain and Service Your Small Computer



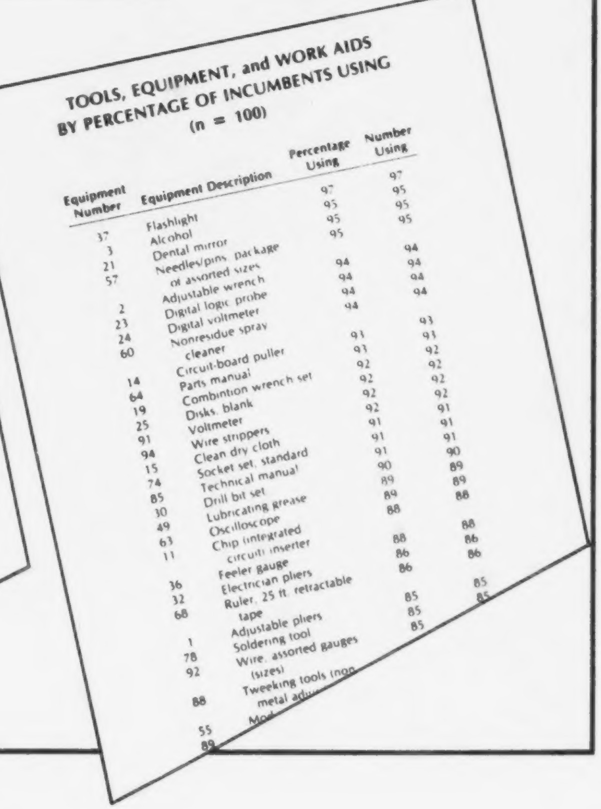
Computer Equipment Repair
OE: 15-0402

Electronic Sales and Service Technician
DOT: 828.251-010

Electronic Field Engineer
DOT: 828.261-014

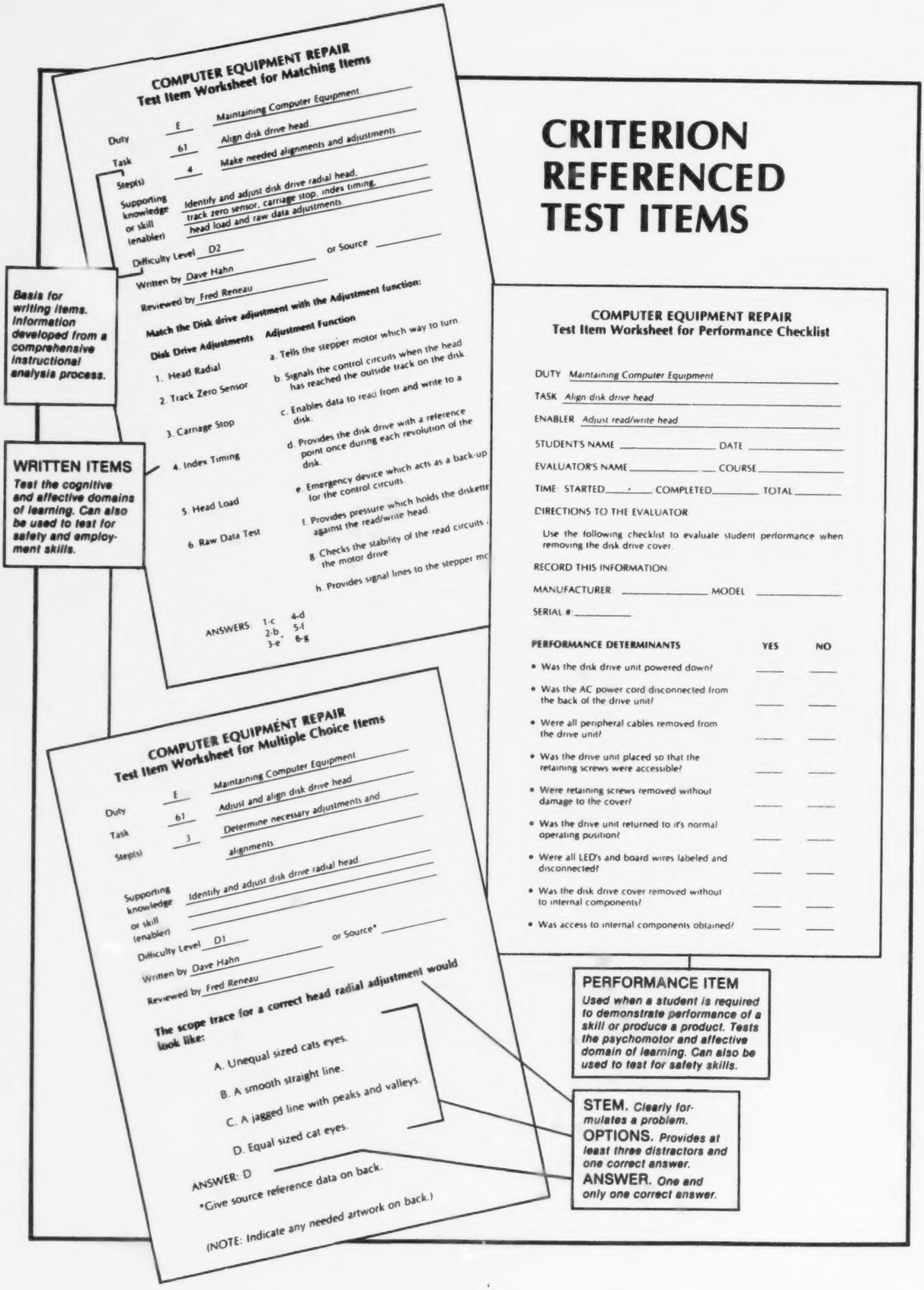
Respondents: n = 100

Duties	Tasks	Performance Objective / Page Numbers	Percent Performing (CER)	
			DOT 1	DOT 2
A. PERFORMING ADMINISTRATIVE FUNCTIONS				
	01 Prepare service bill	1/13	90%	76%
	02 Maintain accounts receivable/paid records	2/14	20	20
	03 Perform public relations activities	3/15	80	84
	04 Maintain labor records	4/17	71	69
	05 Train new service technicians	5/19	75	76
	06 Maintain receiving records	6/20	51	53
	07 Establish customer files	7/22	63	53
	08 Maintain in-stock inventory	8/23	86	88
	09 Order parts	9/25	82	90
	10 Maintain computer equipment inventory	10/26	67	71
	11 Maintain records of service tools and equipment	11/27	67	78
	12 Maintain shipping records	12/28	57	57
	13 Prepare items for shipping	13/29	76	67
	14 Update service manuals	14/31	82	73
	15 Maintain call record report	15/32	43	
	16 Conduct representative meetings	16/33		
	17 Establish customer and equip. history file			
	18 Calculate equipment			
	19 Calculate			
	20 Up			



TOOLS, EQUIPMENT, and WORK AIDS BY PERCENTAGE OF INCUMBENTS USING
(n = 100)

Equipment Number	Equipment Description	Percentage Using	Number Using
37	Flashlight	97	97
3	Alcohol	95	95
21	Dental mirror	95	95
57	Needles/pins, package of assorted sizes	95	95
2	Adjustable wrench	94	94
23	Digital logic probe	94	94
24	Digital voltmeter	94	94
60	Nonresidue spray cleaner	94	94
14	Circuit-board puller	93	93
64	Parts manual	93	93
19	Combintion wrench set	92	92
25	Disks, blank	92	92
91	Voltmeter	92	92
94	Wire strippers	92	92
15	Clean dry cloth	91	91
74	Socket set, standard	91	91
85	Technical manual	91	91
30	Drill bit set	90	90
49	Lubricating grease	89	89
63	Oscilloscope	89	89
11	Chip (integrated circuit) inserter	88	88
36	Feeler gauge	88	88
32	Electrician pliers	86	86
68	Ruler, 25 ft. retractable tape	86	86
1	Adjustable pliers	85	85
78	Soldering tool	85	85
92	Wire, assorted gauges (sizes)	85	
88	Tweeking tools (non metal adju		
55	Mod		
89			



CRITERION REFERENCED TEST ITEMS

COMPUTER EQUIPMENT REPAIR
Test Item Worksheet for Matching Items

Duty	E	Maintaining Computer Equipment
Task	61	Align disk drive head
Step(s)	4	Make needed alignments and adjustments
Supporting knowledge or skill (enabler)		Identify and adjust disk drive radial head, track zero sensor, carriage stop, index timing, head load and raw data adjustments.

Difficulty Level D2 or Source ____

Written by Dave Hahn

Reviewed by Fred Reneau

Match the Disk drive adjustment with the Adjustment function:

Disk Drive Adjustments	Adjustment Function
1. Head Radial	a. Tells the stepper motor which way to turn.
2. Track Zero Sensor	b. Signals the control circuits when the head has reached the outside track on the disk.
3. Carriage Stop	c. Enables data to read from and write to a disk.
4. Index Timing	d. Provides the disk drive with a reference point once during each revolution of the disk.
5. Head Load	e. Emergency device which acts as a back-up for the control circuits.
6. Raw Data Test	f. Provides pressure which holds the diskette against the read/write head.
	g. Checks the stability of the read circuits the motor drive.
	h. Provides signal lines to the stepper mc

ANSWERS: 1-c 2-b 3-e 4-d 5-f 6-g

Basis for writing items. Information developed from a comprehensive instructional analysis process.

WRITTEN ITEMS
Test the cognitive and affective domains of learning. Can also be used to test for safety and employment skills.

COMPUTER EQUIPMENT REPAIR
Test Item Worksheet for Multiple Choice Items

Duty	E	Maintaining Computer Equipment
Task	61	Adjust and align disk drive head
Step(s)	3	Determine necessary adjustments and alignments
Supporting knowledge or skill (enabler)		Identify and adjust disk drive radial head

Difficulty Level D1 or Source* ____

Written by Dave Hahn

Reviewed by Fred Reneau

The scope trace for a correct head radial adjustment would look like:

A. Unequal sized cats eyes.
B. A smooth straight line.
C. A jagged line with peaks and valleys.
D. Equal sized cat eyes.

ANSWER: D

*Give source reference data on back.

(NOTE: Indicate any needed artwork on back.)

COMPUTER EQUIPMENT REPAIR
Test Item Worksheet for Performance Checklist

DUTY Maintaining Computer Equipment
TASK Align disk drive head
ENABLER Adjust read/write head
STUDENT'S NAME ____ DATE ____
EVALUATOR'S NAME ____ COURSE ____
TIME: STARTED ____ COMPLETED ____ TOTAL ____

DIRECTIONS TO THE EVALUATOR:

Use the following checklist to evaluate student performance when removing the disk drive cover.

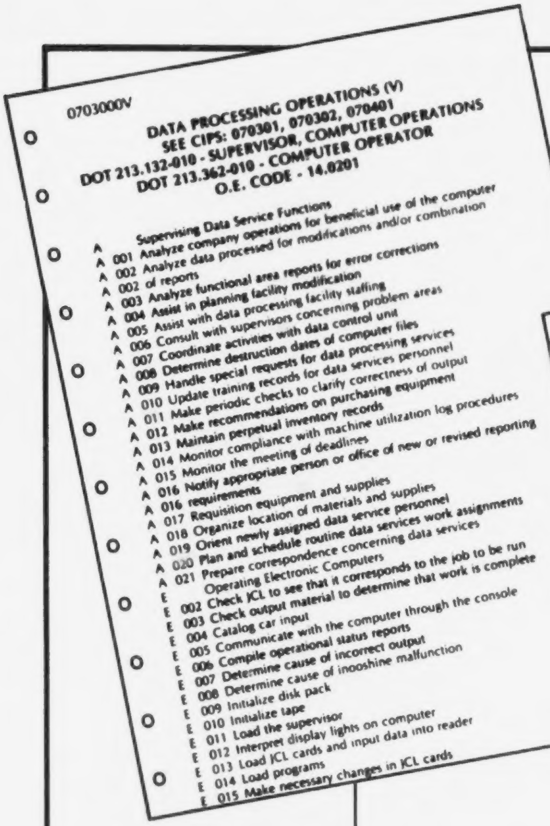
RECORD THIS INFORMATION:

MANUFACTURER ____ MODEL ____
SERIAL #: ____

PERFORMANCE DETERMINANTS	YES	NO
• Was the disk drive unit powered down?	____	____
• Was the AC power cord disconnected from the back of the drive unit?	____	____
• Were all peripheral cables removed from the drive unit?	____	____
• Was the drive unit placed so that the retaining screws were accessible?	____	____
• Were retaining screws removed without damage to the cover?	____	____
• Was the drive unit returned to it's normal operating position?	____	____
• Were all LED's and board wires labeled and disconnected?	____	____
• Was the disk drive cover removed without to internal components?	____	____
• Was access to internal components obtained?	____	____

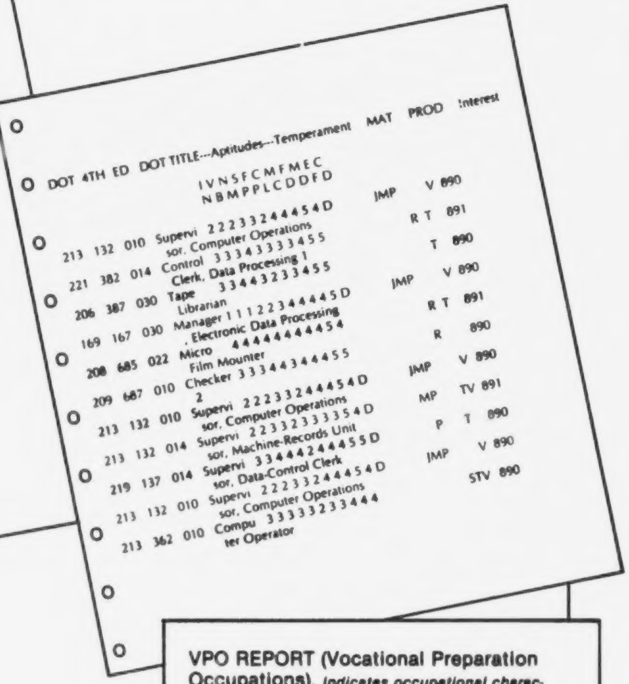
PERFORMANCE ITEM
Used when a student is required to demonstrate performance of a skill or produce a product. Tests the psychomotor and affective domain of learning. Can also be used to test for safety skills.

STEM. ***Clearly formulates a problem.***
OPTIONS. ***Provides at least three distractors and one correct answer.***
ANSWER. ***One and only one correct answer.***



```
0703000V
          DATA PROCESSING OPERATIONS (V)
        SEE CIPS: 070301, 070302, 070401
DOT 213.132-010 - SUPERVISOR, COMPUTER OPERATIONS
     DOT 213.362-010 - COMPUTER OPERATOR
             O.E. CODE - 14.0201

A       Supervising Data Service Functions
A 001 Analyze company operations for beneficial use of the computer
A 002 Analyze data processed for modifications and/or combination
A 002 of reports
A 003 Analyze functional area reports for error corrections
A 004 Assist in planning facility modification
A 005 Assist with data processing facility staffing
A 006 Consult with supervisors concerning problem areas
A 007 Coordinate activities with data control unit
A 008 Determine destruction dates of computer files
A 009 Handle special requests for data processing services
A 010 Update training records for data services personnel
A 011 Make periodic checks to clarify correctness of output
A 012 Make recommendations on purchasing equipment
A 013 Maintain perpetual inventory records
A 014 Monitor compliance with machine utilization log procedures
A 015 Monitor the meeting of deadlines
A 016 Notify appropriate person or office of new or revised reporting
A 016 requirements
A 017 Requisition equipment and supplies
A 018 Organize location of materials and supplies
A 019 Orient newly assigned data service personnel
A 020 Plan and schedule routine data services work assignments
A 021 Prepare correspondence concerning data services
E         Operating Electronic Computers
E 002 Check JCL to see that it corresponds to the job to be run
E 003 Check output material to determine that work is complete
E 004 Catalog car input
E 005 Communicate with the computer through the console
E 006 Compile operational status reports
E 007 Determine cause of incorrect output
E 008 Determine cause of inooshine malfunction
E 009 Initialize disk pack
E 010 Initialize tape
E 011 Load the supervisor
E 012 Interpret display lights on computer
E 013 Load JCL cards and input data into reader
E 014 Load programs
E 015 Make necessary changes in JCL cards
```

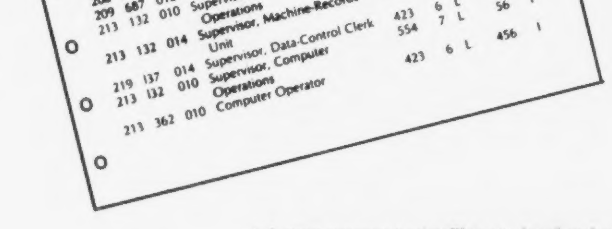


```
DOT 4TH ED  DOT TITLE---Aptitudes---Temperament   MAT   PROD  Interest
                       I V N S F C M F M E C
                       N B M P P L C D D F D
213 132 010  Supervi  2 2 2 3 3 2 4 4 4 5 4 D     JMP     V 890
             sor, Computer Operations                R T  891
221 382 014  Control  3 3 3 4 3 3 3 3 4 5 5               T  890
             Clerk, Data Processing 1
206 387 030  Tape     3 3 4 4 3 2 3 3 4 5 5        JMP     V 890
             Librarian
169 167 030  Manager 1 1 1 2 2 3 4 4 4 4 5 D          R T  891
             , Electronic Data Processing
208 685 022  Micro    4 4 4 4 4 4 4 4 4 5 4           R     890
             Film Mounter
209 687 010  Checker  3 3 3 4 4 3 4 4 4 5 5        JMP     V 890
             2
213 132 010  Supervi  2 2 2 3 3 2 4 4 4 5 4 D      MP    TV 891
             sor, Computer Operations
213 132 014  Supervi  2 2 3 3 2 3 3 3 3 5 4 D       P    T  890
             sor, Machine-Records Unit
219 137 014  Supervi  3 3 4 4 4 2 4 4 4 5 5 D     JMP     V 890
             sor, Data-Control Clerk
213 132 010  Supervi  2 2 2 3 3 2 4 4 4 5 4 D            STV 890
             sor, Computer Operations
213 362 010  Compu    3 3 3 3 3 2 3 3 4 4 4
             ter Operator
```

TASK LIST (partial)

related to these occupational keyword descriptors: computer operating, computer systems, repair service settings.

VPO REPORT (Vocational Preparation Occupations). ***Indicates occupational characteristics such as the General Education Development (GED) requirement for an occupation which includes the reasoning, math, and language level of a specific DOT. Information pertaining to the physical demands, working conditions, and aptitudes, interests, and temperaments associated with different job titles can be obtained.***



```
                                        GED-RML SVP PHYDEM Worked
DOT 4TH ED   DOT TITLE                    554    7  L     56    1
213 132 010  Supervisor, Computer         433    4  S     4 6   1
             Operations                   424    4  L     4 6   1
221 382 014  Control Clerk Data Processing 1 655  8  S    456   1
206 387 030  Tape Librarian
169 167 030  Manager, Electronic Data     211    2  L     4 6   1
             Processing                   322    4  S     4 6   1
208 685 022  Microfilm Mounter            554    7  L     56    1
209 687 010  Checker 2                                    4 6   1 5
213 132 010  Supervisor, Computer         434    7  L
             Operations                                   45    1
213 132 014  Supervisor, Machine-Records  423    6  L     56    1
             Unit                         554    7  L
219 137 014  Supervisor, Data-Control Clerk               456   1
213 132 010  Supervisor, Computer         423    6  L
             Operations
213 362 010  Computer Operator
```

OCCUPATIONAL DATA ANALYSIS SYSTEM

** A new component will soon be developed that will allow ODAS users to manipulate and process the Criterion-Referenced Test Items being developed by V-TECS!*

The following resource is an example of a task analysis form that is used by many competency-based schools in Illinois. This sample was developed by the Stephenson Area Career Center (Illinois).

TASK ANALYSIS FØRM

DUTY D Assisting with Nutritional and Elimination Needs of Patients

TASK 7 Feed Patients (Adults)

Reference for standards: a local advisory committee, from Stephenson Area Career Center

STEPS	STANDARDS (HOW WELL)	TOOLS AND MATERIALS	SAFETY	RELATED KNOWLEDGE SCIENCE	RELATED KNOWLEDGE MATH	RELATED KNOWLEDGE LANGUAGE	ATTITUDES
1. Assist resident/patient to toilet. 2. Wash hands (client and worker). 3. Position client in sitting position. 4. Position over-bed table for client 5. Check tray for: a. Menu b. Equipment c. Spilled foods or liquid and make corrections. 6. Check identification on tray to identification of client. 7. Place tray on over-bed table	90% accuracy on a performance checklist (safety items are critical) 90% accuracy on a written criterion exam (cognitive knowledge).	Serving tray, dishes, utensils Menu, food for client. Client care unit.	Handwashing (asepsis) Check I.D.; client and tray	Digestive system Basic food groups Types of special diets Nutritional needs of the elderly.	Use common fractions. Convert measurements to metrics.		Interpret role and function of N.A. Organize and complete work assignments. Maintain confidentiality. Interpret philosophy, goals & objectives of institution.
a. dinner plate nearest client b. remove covers from hot and cold foods 8. Explain to the client what food is on the tray. 9. Place napkin on clients chest. 10. Sit down near client. 11. Feed client if necessary a. Ask what order client would like food. b. Use straw for liquids. c. Fill utensils half-full. d. Encourage client with-out forcing. e. Feed client slowly. f. Wipe client's mouth if needed. 12. Talk to client regarding appetite, nutritional likes and dislikes. 13. Remove tray. 14. Note how much client ate and drank. 15. Make client comfortable. 16. Wash hands. 17. Record and report how much			Use principles of body mechanics. Handwashing (asepsis)	COMMUNICATIONS Read and interpret written communications. Observe and report client's progress. Prepare written and oral reports. Communicate effectively with clients and staff Participates in conferences and discussions. Communicate using appropriate medical terms. Prepare and conduct interviews. PSYCHO-SOCIAL KNOWLEDGE Identify cultural aspects of care (re: food) Assist in adjustment to institution. Demonstrate sensitivity to losses			Apply patience and flexibility. Demonstrate understanding and acceptance of human behavior. Report violations of policies and procedures affecting the health, safety and well-being of clients. Apply problem-solving skills.

Sample Student Learning Guides

Two learning guides are included for your review.

TSTI-Amarillo	Layout Direct Mail	(343-358)
Pinellas Vocational-Technical Institute Florida	Service and Test a Motorcycle Battery	(359-377)

TSTI AMARILLO

STUDENT LEARNING GUIDE

Student Name: ____________________
Performance Attempts: 1 2 3 4 5 6

PROGRAM: Commercial Art in Advertising
CAA 323 Layout Design

Duty: A Designing layouts
Task: 02 Layout direct mail

Estimated time in **hours** for task completion: 10

INTRODUCTION:

Direct mail advertising reaches far more households than magazines or newspapers because it rarely requires a purchase on the part of the consumer (to receive publication). The consumer has referred to direct mail as "occupant mail" or "junk mail" in the past, but is now coming to take it more seriously.

The advertiser is allowed to have more control over their own spending dollars by producing their own publications, selecting their own prospects, sending copies of their publications to the prospects, and test marketing new products through the mail. We as designers, must "peak the interest" of the public by our designs so that the direct-mail publication has a longer shelf-life, and therefore greater appeal.

OBJECTIVES

PERFORMANCE OBJECTIVE:
(Including condition, performance, and standard)

GIVEN: Access to the proper text, materials, and examples

YOU WILL: Layout direct mail advertising

HOW WELL: Complete a performance test with 70% accuracy.

ENABLING OBJECTIVES:

1. Recognize the types of direct mail and applications of each.
2. Design a direct mail piece.

LIST OF RESOURCES

1. The Design of Advertising, Roy Paul Nelson
2. Student Learning Guide
3. Examples of direct mail

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1:

Enabling objective:

Recognize the types of direct mail and applications of each.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource.	1. The Design of Advertising, pp. 308-319.
2. Take self-check, enabling objective 1.	2. Self-check enclosed.
3. Check answers with answer key.	3. Answer key enclosed.
4. Continue to enabling objective 2.	4. Enabling objective 2 enclosed.

SELF-CHECK FOR ENABLING OBJECTIVE 1:

Directions: Evaluate yourself by answering the following questions.

1. List the types of direct mail outlined in The Design of Advertising text.
2. List applications/differences of each type listed in 1.

SELF-CHECK FOR ENABLING OBJECTIVE 1:
ANSWER KEY

---

1. a. letters
   b. cards and leaflets
   c. folders
   d. broadsides/tabloids
   e. booklets/pamphlets
   f. catalogs
   g. company magazines
   h. annual reports
   i. brochures
   j. 3-D pieces

2. a. single-sheet letterhead-tries to appear as REAL letter
   b. stuffed with letter, statement, etc.
   c. single sheet folded at least once, but more often two/three times, self-contained
   d. large sheet folded to conventional size, usually fits hard-sell client.
   e. carries 8 or more bound pages
   f. mail order primarily
   g. used for public relations, "house organ"
   h. report to stockholders on financial condition of company
   i. elaborate booklet, more costly
   j. may take an unusual shape or contain a sample or advertising tool

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2:

Enabling objective:

Design a direct mail piece

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource A.	1. The Design of Advertising, pp. 306-307
2. Take self-check, enabling objective 2.	2. Self-check enclosed.
3. Check answers with answer key.	3. Answer key enclosed.
4. Continue to Performance Test, Duty A, Task 02.	4. Performance Test enclosed.

SELF-CHECK FOR ENABLING OBJECTIVE **2:**

Directions: Evaluate yourself by answering the following questions.

1. What questions should be asked by the designer when designing a direct mail piece?
2. What is the primary assignment of the designer of a direct mail piece?
3. Do you begin the design by thumbnails? If not, what should you do first?
4. Is the comprehensive mounted?
5. Is sketching paper or actual stock used?

SELF-CHECK FOR ENABLING OBJECTIVE **2**:
ANSWER KEY

---

1. a. Who is the piece going to?
   b. What is the piece trying to accomplish?
   c. Where will it be received?
   d. When should it be received?
   e. When should it be mailed?
   f. Why should the recipient be interested?

2. Get the piece picked up, opened out, and read.

3. no, start by folding and cutting paper.

4. No, let the client unfold it, etc.

5. Actual stock to be printed on is used.

PERFORMANCE TEST FOR Duty A Task 02

DIRECTIONS:

Client-The Hotel Jerome, Aspen, Colorado
Size-8 1/2" x 14" folder
Ink-two colors with screens and special effects (where applicable)
Media-markers, colored pencil, ink

Who is piece going to?

Distributed through travel agencies to persons interested in pleasure/business trips to Aspen area.

What is piece trying to accomplish?

Create idea that The Hotel Jerome is a world class hotel with gracious living as its main selling point.

Where will it be received?

Tourist Bureaus, Aspen Chamber of Commerce, travel agencies nation/worldwide.

Why should the recipient be interested?

The Hotel Jerome offers old world charm, gracious dining, spacious rooms. Bar is a mainstay for locals in Aspen area.

PERFORMANCE TEST FOR Duty A Task 02

The following copy should be used as a guideline for your layout.

The Hotel Jerome epitomizes the past and the present. The Hotel Jerome was built in 1889 as a tribute to the great Silver Boom in Aspen. It was a world-class hotel that also served as the heart of the community.

No expense was spared, no detail overlooked and the Jerome took its rightful place as Aspen's proud jewel. Then, in 1893, silver was de-monetized, the great mines closed and the once-brilliant chandeliers dimmed. Until today...history repeats itself. The Hotel Jerome has been fully restored to its original elegance, combining Victorian splendor with 20th-century comfort. All of the furniture has been refurbished and the original atmosphere recreated. It's this distinctive style of gracious living you'll find when you stay with us. Truly, the Jerome stands out as a world-class hotel in a class all its own.

Exquisite cuisine affords an abundance of choices. The day begins with breakfast at **JACOB'S**. There are some locals who wouldn't think of starting their day without breakfast at the Jerome. And our Sunday brunches have become an Aspen tradition. Lunch at Jacob's is as delicious as the atmosphere.
The **TEA ROOM** is a unique place to meet, relax and take in the surroundings. We serve scrumptious desserts, cappuccino, teas and coffee. Delicious breakfasts and light meals are served from morning to evening.
For dinner, our fine restaurant is appropriately named the grand dame of them all--**THE SILVER QUEEN ROOM**. The ambiance of the restaurant is matchless. Large chandeliers, complimented by romantic candlelight, create a warm, inviting and elegant atmosphere.
The presentation of dinner itself is exquisite. The chef is world renowned and serves only the finest. Our wine selection is capable of pleasing the most discerning connoisseur. And, of course, our desserts and aperitifs are the pride of Aspen.

The rooms allow you to stay in style. "Grand style." Each room is unique and different. Each is elegantly appointed with posh furnishings, original antiques and comfort beyond comparison. Lace curtains grace the tall windows and ornate headboards adorn the beds. The rooms offer luxurious necessities like down comforters, settees, antique writing stands and other 19th century extravagances. The bathrooms are finished in white Carrera marble with black and white octagon tile duplicated from the last century. Oversized white Jacuzzi tubs are an unobtrusive concession to contemporary living. The convenience of a wet bar and refrigerator is a wonderful accessory. Lest we forget...there is room service at one's beck and call.

We have spacious traditional rooms, extraordinary deluxe suites and the ultimate: The Grand Parlour. The furnishings in this luxurious guest suite are genteel enough for visiting royalty...it is the hotel's *piece de resistance*.

Victorian graciousness to contemporary luxury. The pleasure and comfort of our guests has always been the first priority of the Hotel Jerome. Guests are treated with Western hospitality and Victorian grace. Our concierge will personally cater to your every whim. At the Hotel Jerome luxury is a necessity. If pampering and indulgence are what you want, the staff of the Jerome is at your command. From gourmet room service to complimentary wine in your room, the unexpected can be expected here. The Hotel Jerome is based on a tradition of excellence, the traditions prevails today.

The Jerome Bar needs no introduction. The Jerome Bar is a world famous watering hole and the favorite place for locals and visitors to meet. Since the first miners celebrated their silver strikes, the Jerome Bar has maintained its original style. The hallowed walls and furnishings have been preserved in total. The locals have resumed their vigil and the tradition continues. The Jerome Bar more than lives up to its reputation and is the mainstay of town. The place is jumping from early afternoon 'til the wee hours of the morning. It's in all modesty that we can say, if you haven't been in the Jerome Bar, you haven't been to Aspen.

PERFORMANCE TEST FOR Duty A Task 02

Truly the Hotel Jerome is a world Class hotel in a world class resort. Call our toll-free number for information and reservations.

HOTEL JEROME
330 East Main Street
Aspen, Colorado 81611
1-800-882-2582

In Colorado 1-800-423-0037 or (303)920-1000

1. XEROX appropriate photos from **research** materials (ie. brochures, newspaper ads, magazine ads) for use in your folder. Use a maximum of 6 photos and include the enclosed logo on you folder as well.

2. Typestyle selected must be appropriate as well as copyfitting and headline type represented.

3. Consider using a printing special effect if it applies.

4. **DO RESEARCH!!!**

5. Be sure to select an appropriate paper stock for printing of piece. (white is not always the best answer).

6. Make sure the folder entices the reader to open it and read contents.

7. Make sure folder has continuous theme throughout (ie. design effect or photo treatment)

8. **10** thumbnails required per side (two-sides) with instructor's approval.

9. **2** roughs of folder with instructor's approval.

10. **1** finished representation with type set as accurately as possible (Use Macintosh computer).

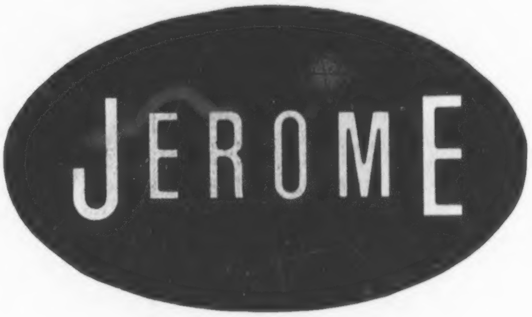
11. Fold roughs and finished piece appropriately and turn them in with all preliminary work to instructor.

12. Be sure that ALL WORK IS LABELLED with task number and your name.

13. Deadline must be received from instructor. ______________________

PERFORMANCE TEST FOR Duty A Task 02

HOTEL JEROME logo---



PERFORMANCE TEST FOR Duty A Task 02
CONTINUED

PERFORMANCE TEST STANDARDS ALL ITEMS MUST BE ANSWERED YES FOR ATTAINMENT	YES	NO
1. Appropriate copy used.		
2. Appropriate typestyle chosen and accurately copyfit and represented.		
3. Theme carries throughout.		
4. **RESEARCH EVIDENCED.**		
5. Appropriate photos used.		
6. Logo used.		
7. Appropriate paper selected.		
8. Adequate thumbnails produced.		
9. Adequate roughs produced.		
10. Finished product accurately produced and folded.		
11. Work adequately labelled.		
12. **DEADLINE MET!**		

Completion of above=70% completion of Performance Test.
See below for point system by which higher rating may be achieved.

14. Creativity evidenced. (5 pts.)

15. Brochure entices audience to read. (10 pts.)

16. Brochure is elegant and readable. (5 pts.)

17. Design layout follows sequential order according to folds. (10 pts.)

TOTAL SCORE (100% possible-A)

prepared by Karen Atkins page 15 of 15

C-6

The following student learning guide was developed at Pinellas Vo-Tech in Clearwater, Florida.

STUDENT LEARNING GUIDE

PVTI

Motorcycle Mechanics

DUTY: SERVICING ELECTRICAL SYSTEMS

TASK: SERVICE AND TEST A MOTORCYCLE STORAGE BATTERY

INTRODUCTION:

Proper servicing and care of motorcycle batteries is necessary to insure long life and good electrical system performance. This learning guide will provide both theory and practice in battery servicing.

PERFORMANCE OBJECTIVE:

Upon completion of this learning guide you will be given some motorcycle batteries. You must test and evaluate these batteries correctly. You will also be given a written test pertaining to battery theory and operation.

ENABLING OBJECTIVES:

1. Answer questions about operation of storage batteries
2. Service, test and evaluate motorcycle storage batteries

DUTY	TASK	PREREQ	STD HRS	WRITER	DATES REVISED		
G	02	G-01	012	MBS	10/07/86		1

ENABLING OBJECTIVE NO.01

PVTI

ANSWER QUESTIONS ABOUT OPERATION OF STORAGE BATTERIES

LEARNING STEPS	RESOURCES
__ 1 VIEW RESOURCE NO. 1 TO IDENTIFY IMPORTANT INFORMATION ABOUT STORAGE BATTERIES.	1 SLIDE PROGRAM NO. G02 'STORAGE BATTERIES'
__ 2 READ RESOURCE NO. 2 TO IDENTIFY FURTHER INFORMATION ABOUT STORAGE BATTERIES.	2 INFORMATION SHEET G02-1 'THEORY AND OPERATION' 'ENCLOSED'
__ 3 READ RESOURCE NO. 3 TO IDENTIFY IMPORTANT SAFETY PROCEDURES.	3 SAFETY SHEET G02-2 'ENCLOSED'
__ 4 COMPLETE RESOURCE NO. 4 TO TEST ? YOUR KNOWLEDGE OF THE STORAGE BATTERY.	4 SELF-CHECK G02-3 'ENCLOSED'
__ 5 WHEN YOU FEEL YOU ARE READY TAKE COMPUTER WRITTEN TEST G-02	
__ 6 PROCEED TO ENABLING OBJECTIVE NO. 2	

DEPT	PROG	DUTY	TASK				
600T	9793	G	02				

INFORMATION SHEET NO. 602-1

PVTI

PAGE 1 OF 3

THEORY AND OPERATION

Small motorcycle batteries are easily damaged by the heat caused by overcharging. Technically, motorcycle batteries should be charged at 1/10 of their rated amp-hour capacity. In other words, a 12 amp hour battery should be charged at not over 1.2 amps.

A 12 volt battery can only produce between 12.6 and 13.2 volts no matter how large it is. It is an 'old wives tale' that jumping a motorcycle with a car battery will damage it's electrical system.

New motorcycle batteries are all 'DRY CHARGED'. The plates have been charged during manufacturing and adding electrolyte will activate the battery.

When servicing a new dry charged battery, it should be filled with electrolyte to a point approximately half way between the upper and lower level lines. After a battery is put into service never add anything but water. The acid never goes away. During charging the water is separated and released as gases.

Distilled water is ideal for batteries but in actual practice it is seldom used. Tap water is fine, but in some sections of the country tap water may contain impurities that can shorten the life of the battery.

New batteries being put into service need a charge at 1/3 their amp-hour rate for 3 to 5 hours to bring them up to full efficiency. A new battery installed in a motorcycle without being fully charged will often have a short life.

Batteries left in a discharged state will begin to form sulphate (a white crystal substance) on the plates. A battery left in this state for very long, a stored motorcycle for instance, will be ruined.

Motorcycle batteries are subject to bad vibration in many cases. Make sure the insulator and the hold-down strap are in place, or the battery may suffer vibration damage from rattling around in the battery box.

Make certain that the battery terminals are clean and free of corrosion and the battery connection wires are not damaged. It is not unusual to find a battery ground wire almost completely eaten away by corrosion. This will cause high resistance in the circuit and the battery can not do it's job.

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

INFORMATION SHEET NO. G02-1

PUTI

PAGE 2 OF 3

Overfilling a battery can cause acid to blow out the vent hose and damage paint and chrome on the motorcycle frame. Be sure that the vent tube is connected and routed to a point underneath the motorcycle. A pinched vent tube can cause the battery to explode.

When servicing new batteries be sure the vent cover is removed before adding acid and charging.

The storage battery is an electrochemical cell which is used to generate electrical energy and which can be recharged after the electrical energy has been partially or completely used up. A storage battery does not manufacture electricity. It merely stores it, in chemical form, for later use, and is capable of doing so repeatedly.

Of every 20 motorcycles checked at random, you would find the following to hold true. One would need a new battery, four would need a recharge, five would need at least one battery cable, and five would need a new battery within 12 months.

Eighty percent of all battery warranty claims result form installing batteries not fully charged.

The solution in the battery is called the electrolyte. It is made of water and sulfuric (or sulphuric) acid. The chemical formula is H_2SO_4.

When batteries are being charged, hydrogen gas is formed at the negative plate of each cell and will escape into the surrounding air through the vent. This is the lightest of all gases and will ignite very easily. (Remember the Hindenburg)

NEVER disconnect of connect a battery or charging cable while the charger is on.

Batteries produce direct current only.

Cell covers are made of hard plastic and they have a rubber sealing ring to create an acid-tight seal. Replace all worn seals.

The specific gravity of a fully charged battery is between 1.260 and 1.270 at 80 degrees F.

Keep the electrolyte level above the plates. If the level is too low the active material on the plates will dry and harden.

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

INFORMATION SHEET NO. G02-1	PVTI

PAGE 3 OF 3

The hydrometer is the device for measuring the specific gravity of electrolyte. Every mechanic should have one in his tool box. Consult the information sheet on your hydrometer for operation.

The electrolyte in batteries, if discharged too much, can freeze and the battery will burst

The positive post of the battery is marked with POS or +. The negative post is marked with NEG or -.

Battery capacity is determined by the size and number of plates. Battery voltage is determined by the number of cells. Each cell has an open circuit voltage of between 2.1 and 2.2 volts.

Freezer and refrigerator frost, when melted, makes a good source of distilled water.

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

SAFETY SHEET NO. G02-2

PUTI

PAGE 1 OF 2

SAFETY FIRST

Sulfuric acid is a highly corrosive acid and should be immediately removed if allowed to come into contact with metals, clothing, floors, or anything other than intentional applications.

The following corrective action may be taken if sulfuric acid is accidentally spilled or splashed on an unwanted area:

FLOOR: Sulfuric acid spilled on the floor may be neutralized with a solution of baking soda and water. 1 pound of soda per gallon of water is sufficient.

CLOTHING: Should sulfuric acid gets on a garment, it must be washed immediately in running water to avoid damage to the fabric. Be sure the garment is removed to eliminate the danger of getting acid on the skin through the material.

BODY: If sulfuric acid is allowed to come into contact with the skin, remove all garments surrounding the affected area and flood the skin with running water of 10 to 15 minutes. Call a doctor is the damage is severe.

EYES: Sulfuric acid in the eyes is most dangerous. If not handled properly blindness can be the result. Carefully follow this procedure:

- Do not rub the eye.
- Force the eye open to a flow of running water for 10 to 15 minutes.
- Summon a doctor immediately, regardless of the severity of the damage.
- Do not use eye drops or other medication before seeing the doctor. He alone should prescribe medication.

PLAY IT SAFE: Use the proper tools and procedures when handling batteries and battery acids. A accident can be dangerous and costly.

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

SAFETY SHEET NO. G02-2

PUT1

PAGE 2 OF 2

COMMON SENSE RULES WHEN HANDLING BATTERIES

- Never attempt to carry more than one battery at a time.
- Never turn a battery upside down for any reason.
- Carry large batteries with an approved strap or sling.
- Charge batteries only in a well-ventilated room or area.
- Do not allow sparks or open flames around a battery being charged, or one that has been recently charged.
- Never 'ARC' a battery to see if it is charged.
- Do not charge a battery at a rate that exceeds the manufacturer's recommendation.
- Keep a container of made-up neutralizer or a box of baking soda on hand.
- Always shield the eyes when working near batteries.

ANTIDOTE: If swallowed drink large quantities of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Call physician immediately.

MORE RULES:

- Never overfill a battery.
- Replace cell covers during charging.
- Turn the battery charger off before connecting or disconnecting the leads
- When removing a battery, disconnect the ground first. When installing a battery connect the ground last.
- Do not breath fumes from a charging battery.
- Never charge a frozen battery.

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

SELF-CHECK NO. G02-3

PUTI

THIS PAGE MUST BE TURNED IN FOR CREDIT: PAGE 1 OF 2

ANSWER THE FOLLOWING QUESTIONS BY FILLING IN THE BLANKS:

The common lead/acid battery in use on motorcycles today is called the 'storage' battery because it stores

____

A twelve volt battery has __________ (how many) cells.

Electrolyte is made up of water and ________________________________

The specific gravity of a fully charged battery should be _________

The instrument used for testing the specific gravity of battery electrolyte is called a ________________________

Under what conditions could a battery explode?

____

In a battery there are approximately __________ volts per cell.

To bring the electrolyte in a battery back to the correct level we will add _____________________

Name 3 visual signs to look for when checking the condition of a battery.

____

____

____

Name two possible causes of sulphation.

____

____

Sulphation is a ___________ (color) crystal deposit on the cell plates.

Name two things that can happen to a battery from overcharging

____

____

A good source of distilled water is

____

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

SELF-CHECK NO. G02-3

PUTI

THIS PAGE MUST BE TURNED IN FOR CREDIT: PAGE 2 OF 2

The correct charging rate for a battery already in service is __________ amp hour rating for at least __________ hours.

When putting a new battery in service the correct charging rate is __________ amp hour capacity for ______________ hours.

Name three important things to look for when routing the vent tube.

____

____

____

Describe the correct procedure for filling a new battery with electrolyte.

____

____

____

____

A twelve amp-hour battery has the capacity to give up twelve amps for __________ hours.

If after charging, the difference in specific gravity between cells is greater than __________ %, the battery should be replaced.

WHEN YOU HAVE FINISHED THIS SELF-CHECK SHOW IT TO YOUR INSTRUCTOR. HE WILL DISCUSS IT WITH YOU.

YOU MUST TURN THIS SELF-CHECK IN FOR CREDIT!

NAME: ____

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

ENABLING OBJECTIVE NO.02

PVTI

SERVICE TEST AND EVALUATE MOTORCYCLE BATTERIES

LEARNING STEPS

__ 1 READ RESOURCE NO. 1 TO IDENTIFY THE CORRECT PROCEDURES FOR SERVICING TESTING AND EVALUATING A MOTORCYCLE BATTERY.

__ 2 COMPLETE RESOURCE NO. 2 FOR PRACTICE.

__ 3 WHEN YOU FEEL YOU ARE READY TAKE PERFORMANCE TEST G-02.

RESOURCES

1 INSTRUCTION SHEET G02-4 'SERVICING TESTING AND EVALUATING" 'ENCLOSED'

2 SELF-CHECK G02-5 'ENCLOSED'

DEPT	PROG	DUTY	TASK				
600T	9793	G	02				

INSTRUCTION SHEET NO. G02-4

PUTI

PAGE 1 OF 2

SERVICING, TESTING AND EVALUATING

PREPARING NEW BATTERIES:

1. Remove the battery from it's carton and sealed wrapping.

2. Remove all fill plugs.

3. Cut off the sealed end of the vent tube (Illus. G02-1). Some batteries will be shipped with a short vent cap attached. Simply remove the short vent tube and replace it with the long vent tube provided.

4. Fill each cell with electrolyte to the upper level mark. Be careful not to spill any electrolyte because it is very corrosive.

5. Let battery stand for 30 minutes to allow the plates and seperators to absorb the electrolyte.

6. Refill with electrolyte to the upper level if necessary.

7. Replace all fill plugs and tighten the securely.

8. Wash the battery thoroughly with water and then dry it.

9. Charge the battery for 3 to 5 hours at approximately 1/3 amp-hour rating.

10. Check the electrolyte level after charging. If the level is low, fill to the upper level with water not electrolyte.

11. Install the battery in the motorcycle making sure you follow the manufacturer's instructions for installation

12. Make sure the vent tube is routed to a point underneath the motorcycle

---

BATTERIES ALREADY IN SERVICE:

1. Remove the battery from the motorcycle (Illus. G02-2).

2. Clean any corrosion, dirt or oil from the battery (Illus. G02-3).

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	02			

INSTRUCTION SHEET NO. G02-4

PUTI

3. Check the battery for signs of swelling, mossing or cracking. All of these conditions require battery replacement.

4. Check for signs of sulphation. If sulphation is present, charging for 60 to 100 hours at 1/2 the normal charge rate may revive the battery.

5. If electrolyte level is low fill to upper level with distilled water.

6. Replace any damaged fill caps.

7. Charge the battery at 1/10 amp-hour rating for approximately 10 hours. (Illus. G02-4)

8. Using a battery hydrometer, check the specific gravity of all the cells and record the answers on a piece of paper (Illus. G02-5). If there is a difference of two floating balls between any of the cells then the battery should be replaced. If the battery is not at least 3/4 charged then repeat step 7 until it is. If the battery will not reach 3/4 charge then replace it.

9. Make an open circuit voltage test. A fully charged 12 volts battery will read 12.6 to 13.2 volts. A fully charged 6 volt battery will read 6.3 to 6.6 volts (Illus. G02-6). If the voltage readings are 4 or lower for a 6 volt battery or 10 or lower for a 12 volt battery then replace it.

10. Check the battery under load. Connect the battery back in the motorcycle. Turn on the headlight, the brakelight and the turn signals. Check the voltage. If the meter reads below 10 volts for a 12 volt battery or 4 volts for a 6 volt battery the battery needs replacing.

11. If you have followed these steps and everything checks OK then the battery is usable.

12. Check to make sure the battery is installed correctly as per the manufacturer's recomendations.

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	02			

SELF-CHECK NO. G02-5

PUTI

THIS PAGE MUST BE TURNED IN FOR CREDIT: PAGE 2 OF 3

CK

---- 8. What is the open-circuit voltage? ------------------------

---- 9. What is the voltage under load? --------------------------

In the space provided below, give your evaluation of the condition of this battery.

Have your instructor assign you a battery already in service. Following the directions from Instruction Sheet G02-4 test, evaluate and service the battery and record your findings below:

CK

---- 1. Clean the battery.

---- 2. Are there any signs of mossing, swelling, cracking or sulphation? If yes, what are they?

---- 3. Was the electrolyte level low or high? ------------------

---- 4. Are there any damaged fill caps? ------------------------

---- 5. Record hydrometer readings.

Cell #1 -------------------- Cell #2 --------------------

Cell #3 -------------------- Cell #4 --------------------

Cell #5 -------------------- Cell #6 --------------------

---- 6. Charge battery for prescribed time.

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

SELF-CHECK NO. G02-5

PVTI

THIS PAGE MUST BE TURNED IN FOR CREDIT: PAGE 1 OF 3

Memorize the steps involved in PREPARING NEW BATTERIES found on Instruction Sheet G02-4. When you are thoroughly familiar with all the steps, explain them to your instructor.

INSTRUCTOR SIGNATURE --------------------------

Have your instructor assign you a battery already in service. Following the directions from Instruction Sheet G02-4 test, evaluate and service the battery and record your findings below:

CK

---- 1. Clean the battery.

---- 2. Are there any signs of mossing, swelling, cracking or sulphation? If yes, what are they?

---- 3. Was the electrolyte level low or high? ------------------

---- 4. Are there any damaged fill caps? -------------------------

---- 5. Record hydrometer readings.

Cell #1 -------------------- Cell #2 --------------------

Cell #3 -------------------- Cell #4 --------------------

Cell #5 -------------------- Cell #6 --------------------

---- 6. Charge battery for prescribed time.

---- 7. Record hydrometer readings.

Cell #1 -------------------- Cell #2 --------------------

Cell #3 -------------------- Cell #4 --------------------

Cell #5 -------------------- Cell #6 --------------------

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

SELF-CHECK NO. G02-5

PVTI

THIS PAGE MUST BE TURNED IN FOR CREDIT:

PAGE 2 OF 3

CK

---- 8. What is the open-circuit voltage? ------------------------

---- 9. What is the voltage under load? --------------------------

In the space provided below, give your evaluation of the condition of this battery.

Have your instructor assign you a battery already in service. Following the directions from Instruction Sheet G02-4 test, evaluate and service the battery and record your findings below:

CK

---- 1. Clean the battery.

---- 2. Are there any signs of mossing, swelling, cracking or sulphation? If yes, what are they?

---- 3. Was the electrolyte level low or high? ------------------

---- 4. Are there any damaged fill caps? -------------------------

---- 5. Record hydrometer readings.

Cell #1 -------------------- Cell #2 --------------------

Cell #3 -------------------- Cell #4 --------------------

Cell #5 -------------------- Cell #6 --------------------

---- 6. Charge battery for prescribed time.

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

SELF-CHECK NO. G02-S

PUT I

THIS PAGE MUST BE TURNED IN FOR CREDIT: PAGE 3 OF 3

CK

---- 7. Record hydrometer readings.

Cell #1 -------------------- Cell #2 --------------------

Cell #3 -------------------- Cell #4 --------------------

Cell #5 -------------------- Cell #6 --------------------

---- 8. What is the open-circuit voltage? ------------------------

---- 9. What is the voltage under load? --------------------------

In the space provided below, give your evaluation of the condition of this battery.

Have your instructor check your work and sign below.

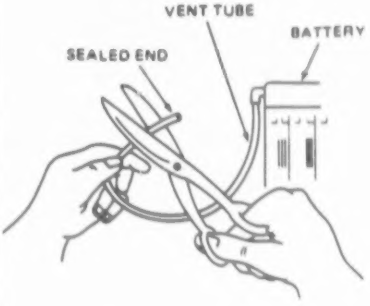
THIS SELF-CHECK MUST BE TURNED IN FOR CREDIT!

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	01			

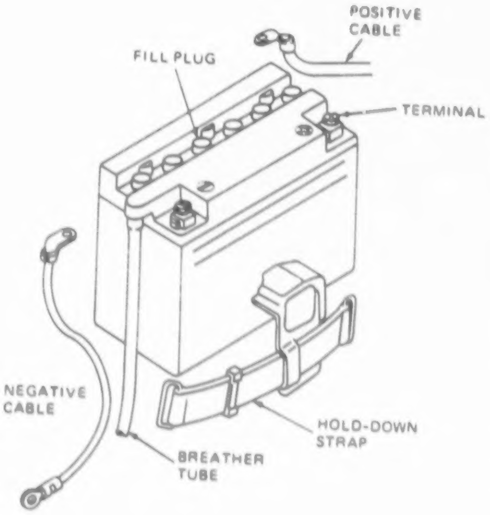
ILLUSTRATION SHEET NO. G-02

PUT1

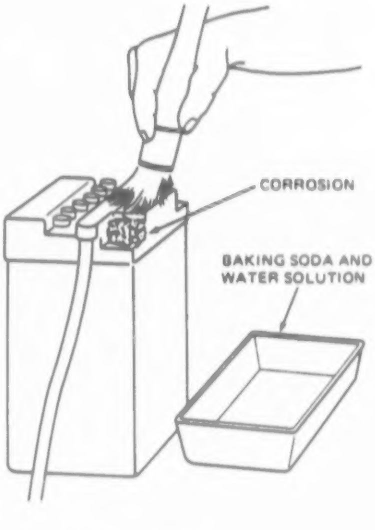
PAGE 1 OF 2


VENT TUBE
BATTERY
SEALED END

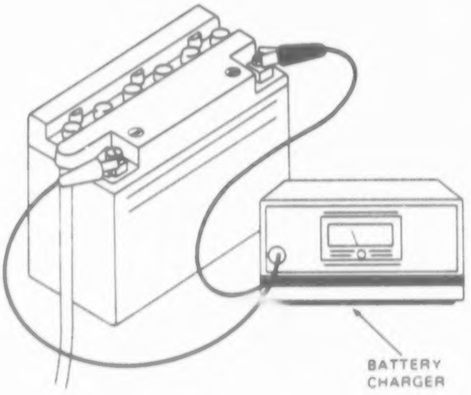
Illus. G02-1


POSITIVE CABLE
FILL PLUG
TERMINAL
NEGATIVE CABLE
HOLD-DOWN STRAP
BREATHER TUBE

Illus. G02-2


CORROSION
BAKING SODA AND WATER SOLUTION

Illus. G02-3


BATTERY CHARGER

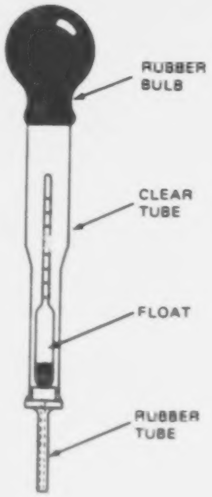
Illus. G02-4

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	02			

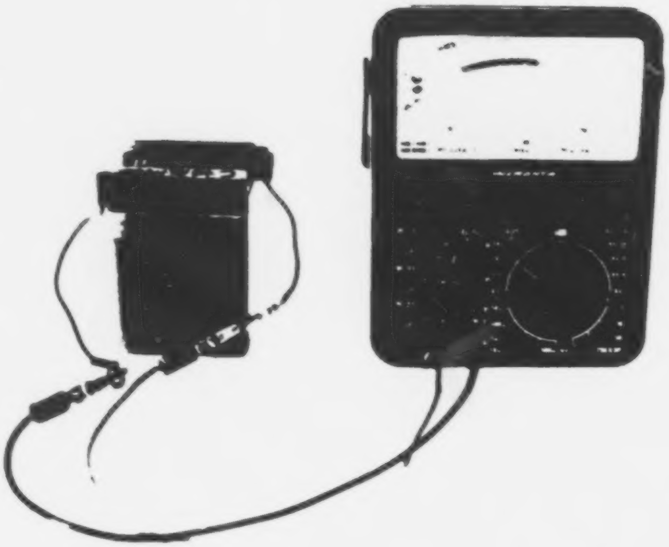
ILLUSTRATION SHEET NO. G-02

PVT I

PAGE 2 OF 2


RUBBER BULB
CLEAR TUBE
FLOAT
RUBBER TUBE

Illus. G02-5



Illus. G02-6

DEPT	PROG	DUTY	TASK	EN OBJ			SEQ
600T	9793	G	02	02			

PERFORMANCE TEST FOR G-02	PVTI

TASK:	SERVICE AND TEST STORAGE BATTERIES

STUDENT NAME ______________________________ DATE ______________

DIRECTIONS TO STUDENT:

Using the information and procedures you acquired during the execution of this Learning Guide, you will service, test and evaluate an assigned motorcycle battery. All steps must be performed correctly.

DIRECTIONS TO EVALUATOR:

Observe the student as he procedes through this Performance Test. Use the following items as a guide. All steps must be performed correctly.

CRITICAL	ITEMS TO BE EVALUATED	YES	NO
	Explain to the evaluator the correct procedure for preparing new batteries.		
	BATTERY IN SERVICE		
	1. Battery cleaned correctly.		
	2. Visual inspection. Record any discrepancies. --- ---		
	3. Hydrometer readings before charging.		
	Cell #1 ------------------------		
	Cell #2 ------------------------		
	Cell #3 ------------------------		
	Cell #4 ------------------------		
	Cell #5 ------------------------		
	Cell #6 ------------------------		
	CONTINUED NEXT PAGE!		

DEPT	PROG	DUTY	TASK				SEQ
600T	9793	G	02				

PERFORMANCE TEST FOR G-02

CONT

CRITICAL	ITEMS TO BE EVALUATED	YES	NO
	4. Battery charged correctly.		
	5. Hydrometer readings after charging.		
	Cell #1 ------------------------		
	Cell #2 ------------------------		
	Cell #3 ------------------------		
	Cell #4 ------------------------		
	Cell #5 ------------------------		
	Cell #6 ------------------------		
	6. Record open circuit voltage. --------------------------------		
	7. Record voltage under load. --------------------------------		
	8. Record evaluation of battery condition. -- -- -- --		

DEPT	PROG	DUTY	TASK				SEQ
600T	9793	G	02				

Component D

Managing Competency-Based Education

Purpose

The successful implementation of competency-based education requires an effective management system. The management system you develop is dependent on many factors. A management system for a CBE training program that allows open entry/exit and is self paced will be different from one that is course structured and enrolls students on a semester basis. This component of the Resource Guide does not have all the answers to management questions but does contain suggestions and information that others who have successfully adopted CBE are using. Grading, attendance, progress, student orientation, implementation plan development, staff development, facility organization, task sequencing and learning guide production will be briefly discussed in this component.

Table of Contents

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D-2 Managing Program/Departmental Activities (386-410)
D-3 Staff Development (411-412)
D-4 Student Orientation (413-415)
D-5 Grading (416-417)
D-6 Attendance/Progress (418)
D-7 Task Mapping (419-421)
D-8 Learning Guide Production/Quality Control (422)
D-9 Desirable Characteristics of a Learning Resource Center (423-425)
D-10 Component D-Resource Listing (426-464)

Management and Implementation

D-1

Up to this point in the Resource Guide we have looked at the methods of planning and developing a training program. The major emphasis was directed to instructional content and delivery. In this component we will review several management concepts. The management plan or strategy developed at your school will be dependent on the scope of your implementation effort. Section A (page 16-19) listed nine characteristics or elements of CBE programs. Only three of these elements were considered essential. If your training program has only the three essential elements; your management strategy will be quite different from a strategy that addressed all nine. When all students begin training at the same time, go through instruction at the same rate and exit at the same point, managing instruction is not that complicated. Your management plan also would be quite different if you were converting only one training program to CBE as opposed to a multiprogram or complete school or system implementation effort.

Component B (page 71) of the Resource Guide briefly discussed developing an overall design of a CBE system of learning. The resource section of Component B contained a document that listed questions that need to be answered before determining the overall design of a CBE system of learning (page 120). Please turn to page 120 and review these questions. Any management plan that you develop will be more effective if it takes all the various implementation factors into consideration. After you have reviewed the questions on page 120 you will have a better understanding of the complexity of designing a mangement plan to implement and provide the necessary support to assure the effective operation of a competency-based education program on a daily basis.

Staff Support

Before any management plan is developed it is critical that two key factors are in place: staff support and staff involvement.

It is essential that administrators, instructors, staff and students support the competency-based education implementation effort for any management plan to be successful. The term "competency-based education" and other associated vocabulary such as "open entry", "individualized instruction", "self paced" etc. are often misunderstood by many. Instructors and support staff should realize that CBE is an effective method of delivering vocational technical education and not the latest fad in education. One technique that has proven successful in "convincing" faculty and staff of the value of competency-based education is having them visit schools that have successfully adopted it. Instructors are more willing to adopt something if they can actually see it in operation. One sure way of having a competency-based implementation effort fail is to "force" instructors to adopt it.

Competency-based education effects all operations of a school. Many implementation efforts have failed because the implementation plan did not involve various departments (divisions) within a school but only focused on the instructional elements of CBE. The registrar, financial aid officer and other individuals who will be effected need to be consulted. Adjustments need to be made if a program is open entry/exit especially in the areas of registration and financial aid. Instructional delivery is not the only element involved in developing a mangement plan or strategy.

Schools that have successfully adopted CBE have involved faculty and staff in planning the implementation effort. If staff and faculty have a vested interest in the success of the implementation effort and do not view it as something that is being "forced" on them by administration there is a greater chance for success. The authors of this publication recommend that schools considering the adoption of competency-based education form an implementation committee composed of a cross section of faculty, staff and students. This committee should be actively involved in developing implementation and management plans.

Whatever the plan of implementation is, a plan of action (in writing) is necessary. A lot of time, energy and money will be wasted unless a detailed written plan of action is in place. A plan of action can be developed using a variety of formats such as MBO, PERT charts, timelines, flowcharts and others. In any plan of action, goals (objectives) should be identified. These goals (objectives) need to be analyzed into specific activities necessary to accomplish the goal. Specific activities need to include dates, who is responsible, costs and other necessary information.

Goals for Adopting Competency-Based Education

The following is a list of goals (objectives) that would be typical for a school in the process of adopting competency-based education.

Objective 1: Identify the Competency-Based Delivery System to be Used.

Objective 2: Develop Task List(s) for Each Program.

Objective 3: Design a Student Learning Format

Objective 4: Develop Grading/Progress System

Objective 5: Develop a Lab/Classroom Management System.

Objective 6: Develop and Conduct a Teacher Training Program.

Objective 7: Develop Implementation Plan/Timeline.

Once goals are established they need to be translated into specific accomplishments. The form on the next page illustrates the "breakdown" of objective #2 (Develop Task Lists for Each Program).

PROGRAM DEVELOPMENT OBJECTIVE NO. 2		Develop Task Lists For Each Program											
Accomplishments		**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**
a.	Describe specific occupation program is training for.	▬											
b.	Select method/survey (DIF or DACUM)		▬	▬	▬								
c.	Conduct search for previously developed task listings at other institutions.					▬	▬						
d.	Conduct in-service training on how to develop task listings/surveys.						▬	▬					
e.	Mail out task surveys for validation.								▬	▬			
f.	Tabulate, revise and finalize task listings for each program.										▬	▬	

	To Begin	To Complete	Person Responsible	Estimated Cost	Comments
a.	Aug.3	Aug. 26	Program Chairperson	0	Either DACUM or DIF
b.	Sept. 2	Nov. 24	CBE Faculty Committee	0	
c.	Dec. 2	Jan. 28	Curriculum Coordinator	1500	
d.	Jan. 1	Feb. 27	Dean of Instruction	2000	Contact William Blank
e.	Mar. 3	Apr. 29	Curriculum Coordinator	500	
f.	May 1	June 30	Program Chairperson	0	Use data base program

The following list of "Worst CBE Implementation Mistakes You Can Make" was developed by William Blank. Read it and be careful to avoid these "worst mistakes" when developing management plans.

WORST CBE IMPLEMENTATION MISTAKES YOU CAN MAKE:

1. Not have an implementation plan.
2. Have a bad plan and use it.
3. Have a good plan and not use it.
4. Cram it down instructor's throat.
5. Make it a "top-down" innovation.
6. Never bother to explain in detail what it is, why it is better, where it is working, where it is not working.
7. Implement too much, too soon
8. Carve the CBE system in stone before pilot testing and refining.
9. Refuse to admit you are wrong and to change.
10. Be too democratic, committee oriented and soft-hearted.
11. Be too autocratic, egotistical, pig-headed.
12. Use competencies written too narrowly or too broadly.
13. Have too many theory competencies.
14. Put competencies in too rigid sequence.
15. Have an educationally unsound learning package format.
16. Use a learning package format designed for educators-not students.
17. Use some odd-ball, one-of-a-kind format.

18. Package too many competencies (and packages) into a single thick booklet.

19. Try to rewrite everything; not use existing resources.

20. Over reliance on the use of videotapes for instruction.

21. Use a centrally located learning resource center (LRC).

22. Don't train instructors how to develop good materials or how to implement the program.

23. Forget about management system or throw it together.

24. Make using the system "optional".

25. Impose unrealistic deadlines.

26. Don't adequately fund or support the effort.

27. Teach theory separate from practical application.

28. Leave the physical facility like it is now.

29. Don't orient students adequately.

It is impossible to provide one set of standard guidelines that would apply to every competency-based education program. If your implementation effort involved the adoption of only the three essential elements of CBE, your management system would be quite different from a training program that utilized all nine elements (see pages 16-19).

St. Petersburg Vo-Tech. Institute in St. Petersburg, Florida incorporates all nine elements of CBE in its training programs and has developed a computerized management system that is easily adopted to the specific needs of a variety of competency-based education programs. The management system is inexpensive and personal computers can be used to implement it.

The next several pages of section D-2 explain St. Petersburg's computerized competency-based management system. The description of this management system was included because it addresses all nine elements of competency-based education.

INTRODUCTION

In an effort to improve the efficiency and effectiveness of vocational education programs, many states, school districts and institutions are moving away from the more traditional approach to vocational education and are adopting the "competency-based" approach. Put simply, the competency-based approach to vocational education and training (CBVE) has the following characteristics that distinguish it from the more traditional or conventional approach.

COMPETENCY BASED Each program or course is based on precisely stated, occupationally validated "competencies" which describe what the trainee will be able to do upon completion of the program (such as "file material alphabetically," "weld a tee joint in overhead position" or "select and apply herbicides to turf grass.") These competencies are often called "tasks."

MODULARIZED INSTRUCTION Rather than by group oriented lectures and demonstrations, much of the instruction students receive is delivered by carefully developed learning packages or "modules" supported by appropriate media.

MASTERY LEARNING Each individual student is required to reach an identified level of proficiency in each competency before being allowed to move on to the next competency. The level of proficiency is defined in the criterian reference of each module.

INDIVIDUALIZED The primary focus of instructions is on the individual student rather than on the entire group of students.

PERFORMANCE BASED Each individual student must demonstrate his/her mastery of each competency in a job-like setting before being given credit for mastery of that competency.

SELF-PACED Students proceed through the instructional modules and through the program at their own pace rather than with a group. Students may speed up or slow down as their learning needs indicate (within established guidelines).

Delivering vocational education by using the competency-based individualized approach provides several very significant benefits.

These include:

- Students can focus their learning efforts on one competency at a time,
- Students, instructors and others know exactly what is to be accomplished and how well,
- Each student is given both the time and help needed to learn one thing well before having to move on to the next,
- More students reach higher levels of competency than was possible using the traditional lock-step and group oriented approach.
- The program respects the individuals learning pace, preferred learning style and specific program need.

As vocational educators explore the competency-based approach, one major concern is often raised--management. Many instructors introduced to competency-based, vocational education concepts agree that the potential for improved programs quality is there--if the system can be managed effectively.

Typically, instructor's management concerns are:

(1) managing the physical aspects including equipment, tools, supplies, etc.
(2) managing student progress, time, discipline and
(3) managing data or information.

Data management questions often asked by instructors include:

"How will I keep track of who is working on which competency?"
"How will I know when each student begins and completes a module?"
"How can I keep track of the average time students are actually spending on each module?"
"How can I effectively document which competency has been attained by each student and when?"
"How can I spot a student who has fallen behind before he/she becomes frustrated and gives up?"

This booklet describes a computerized competency-based data management system developed by St. Petersburg Vocational Technical Institute (SPVTI) that was designed to help instructors answer these and other questions in an accurate and timely fashion.

This or any other data management system will not solve all the problems and challenges associated with successfully implementing CBVE. It is, however, a powerful tool that the instructors, the school administration and, yes, even the student can use to collect, store, analyze, and report important individual and class data.

In the remainder of this document, the various documents and printouts compiling the system will be described in detail. These will be organized around three basic sections which correspond to three data management concerns faced in implementing competency-based learning:

Documenting program and task requirements.

- How can we clearly document programs and course requirements such as competencies required, average time length for completion, etc.

Monitoring individual and class progress.

- How can we routinely monitor individual and class progress? and

Documenting and reporting mastery

- How can we accurately report and document student mastery of competencies?

DOCUMENTING PROGRAM REQUIREMENTS

One of the major problems of the conventional approach to vocational education is the difficulty in being able to clearly document or describe exactly what the completion requirements of each program or course are. Often, we can examine course outlines, program guides and related course and program documents and still not be able to tell exactly what it is the successful student will be able to do at the end of the training program.

Task Listing

St. Pete Vo-Tech's competency-based systems of learning, as most CBVE systems do, is based on validated, precisely stated "competencies" or "tasks." For each program at SPVTI, there is a document called a "task listing." On the task listing are listed the specific skills or competencies students must demonstrate mastery of to successfully complete the program and receive a diploma. These competencies or "tasks" as they are often called have been verified by the program's local opportunity advisory committee as being essential for entry level employment. On the next page is a sample of a task listing for one of SPVTI programs (File Clerk). Looking at this sample, you will notice that the task listing contains the following information:

(A) Program name such as auto mechanics, culinary arts, etc.

(B) Program number - this number identifies the specific training programs represented by this particular task listing.

(C) Major "duties" - the tasks on the task listing are grouped into major categories of similar tasks called "duties."

(D) "Tasks" - this column lists the specific tasks upon which the program is based. Notice that each task begins with an action verb (e.g. "type," "build," "solve," "identify," etc.) and describes exactly what the student will be able to do upon mastering the task.

(E) Code number for each duty - Each major duty is given a code number. Duty numbers are always in the exact "hundreds" (e.g. 1200, 1500, 1800, etc.) Notice that sufficient numerical spacing has been left for later insertion of new duties between every two existing duties.

(F) Code numbers for each task - This four digit code number identifies each task within a given program (e.g. task 0318 is "type blocked letters"). Using the appropriate program code number (e.g. 7660 - 03) and the appropriate task number (e.g. 2403), we can distinguish the task "operate a ten key adding machine" from the approximately 5000 other tasks contained on the task listings for the other 50 programs throughout the school.

(G) Standard Hours - In this column we find an important bit of data: the standard hours students have spent working in each task. This information is used three ways:

1. The standard time for a given task gives the student an indication of the amount of time allocated for each task. This is based on the amount of time others have spent on that task. If the student is spending considerably more time than allocated, the instructor should evaluate the progress and provide remedial assistance.

2. The total time spent on each task determines the length of the entire program. This information is available for all interested students.

3. The standard time for each task is used in computing student progress. See Example I - A.

Task Listing Computerized Versions

The task listing shown on the following page is very similar to task listings used in other competency based vocational programs. The major difference in the SPVTI task listing is that in addition to this "manual" version, there is also a computerized version.

A sample of the computerized version of the progam task listing for the file clerk program is shown. The computerized version contains the following additional information.

(A) Report Number
(B) Dept. No. and Name - This information appears on all printouts. Indicates in what department this particular program is (e.g. file clerk is in Dept. #02 - Business.
(C) Average length in weeks and hours
(D) Hours per day normally in session
(E) Days per week normally in session
(F) Date

The advantages of basing each program on precisely stated validated competencies and task listings shown in the previous sample offers the following advantages:

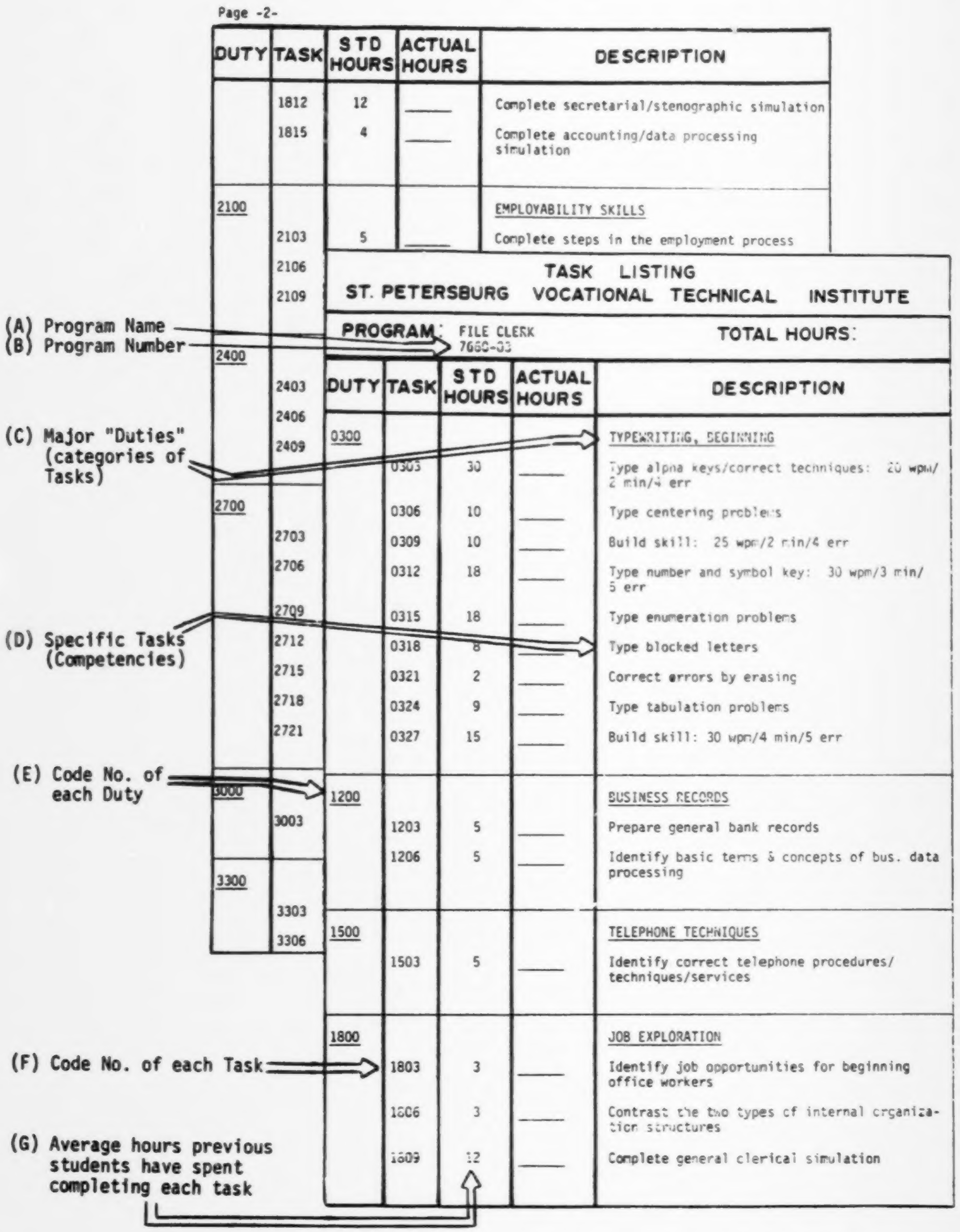
* anyone can look at the task listing and determine what is taught in the training program.

* since the program competencies are written each year competencies can be added to, deleted, and refined to remain as close as possible to the required competencies needed by business and industry.

* The curriculum, tests, audio visuals and other program materials are developed to support student's mastery of the competencies listed.

Using a computerized task listing is a more efficient way of updating, revising, and printing the tasks required for each program. See Example I - B.

I - A



Page -2-

DUTY	TASK	STD HOURS	ACTUAL HOURS	DESCRIPTION
	1812	12	_____	Complete secretarial/stenographic simulation
	1815	4	_____	Complete accounting/data processing simulation
2100				EMPLOYABILITY SKILLS
	2103	5	_____	Complete steps in the employment process
	2106			
	2109			
2400				
	2403			
	2406			
	2409			
2700				
	2703			
	2706			
	2709			
	2712			
	2715			
	2718			
	2721			
3000				
	3003			
3300				
	3303			
	3306			

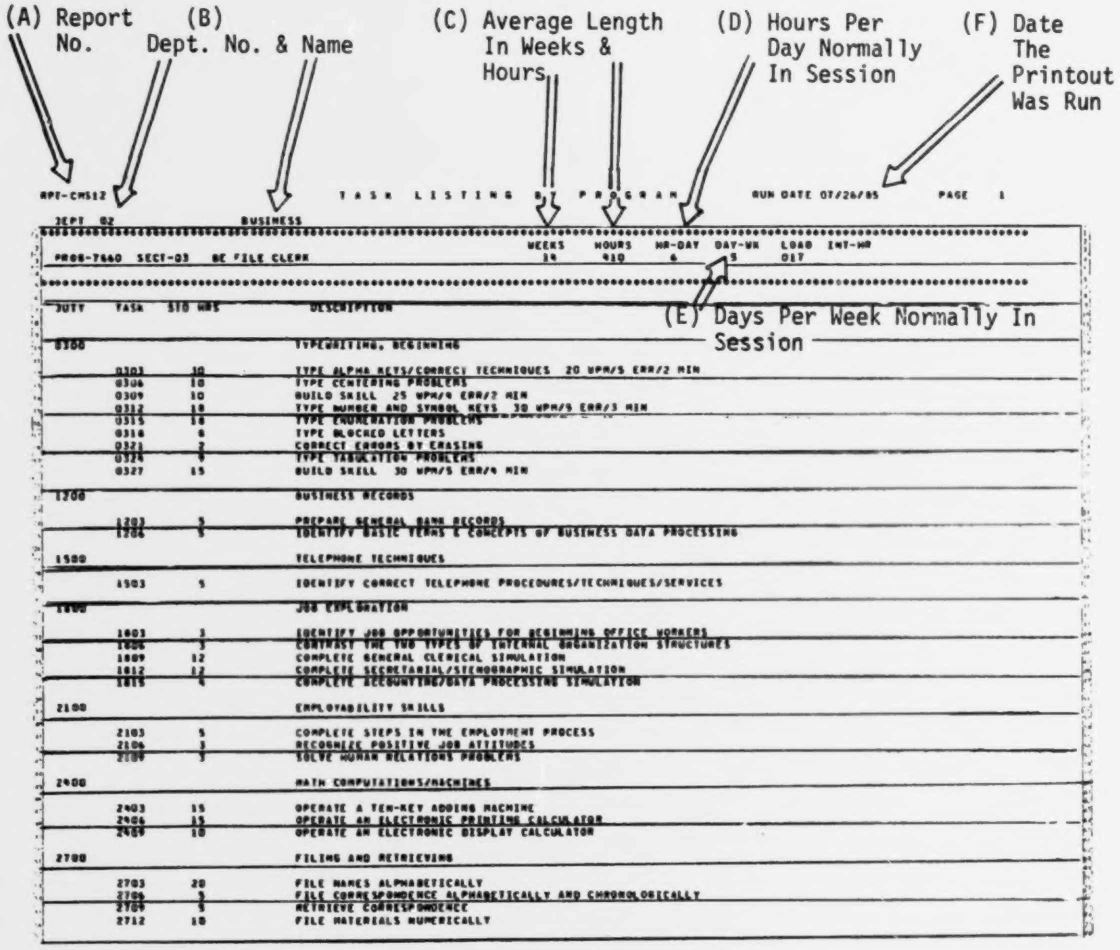
TASK LISTING
ST. PETERSBURG VOCATIONAL TECHNICAL INSTITUTE

PROGRAM: FILE CLERK
7660-03
TOTAL HOURS:

DUTY	TASK	STD HOURS	ACTUAL HOURS	DESCRIPTION
0300				TYPEWRITING, BEGINNING
	0303	30	_____	Type alpha keys/correct techniques: 20 wpm/2 min/4 err
	0306	10	_____	Type centering problems
	0309	10	_____	Build skill: 25 wpm/2 min/4 err
	0312	18	_____	Type number and symbol key: 30 wpm/3 min/5 err
	0315	18	_____	Type enumeration problems
	0318	8	_____	Type blocked letters
	0321	2	_____	Correct errors by erasing
	0324	9	_____	Type tabulation problems
	0327	15	_____	Build skill: 30 wpm/4 min/5 err
1200				BUSINESS RECORDS
	1203	5	_____	Prepare general bank records
	1206	5	_____	Identify basic terms & concepts of bus. data processing
1500				TELEPHONE TECHNIQUES
	1503	5	_____	Identify correct telephone procedures/techniques/services
1800				JOB EXPLORATION
	1803	3	_____	Identify job opportunities for beginning office workers
	1806	3	_____	Contrast the two types of internal organization structures
	1809	12	_____	Complete general clerical simulation

(A) Program Name
(B) Program Number
(C) Major "Duties" (categories of Tasks)
(D) Specific Tasks (Competencies)
(E) Code No. of each Duty
(F) Code No. of each Task
(G) Average hours previous students have spent completing each task

I - B


(A) Report No.
(B) Dept. No. & Name
(C) Average Length In Weeks & Hours
(D) Hours Per Day Normally In Session
(F) Date The Printout Was Run
(E) Days Per Week Normally In Session

```
RPT-CMS12                                     T A S K   L I S T I N G   B Y   P R O G R A M           RUN DATE 07/26/85        PAGE   1
 DEPT  02                          BUSINESS
***************************************************************************************************************
                                                               WEEKS    HOURS   HR-DAY  DAY-WK   LOAD  INT-HR
 PROG-7660  SECT-03   BE FILE CLERK                              14      410       6       5      017
***************************************************************************************************************
 DUTY    TASK   STD HRS          DESCRIPTION

 0300                            TYPEWRITING, BEGINNING

         0303      10            TYPE ALPHA KEYS/CORRECT TECHNIQUES  20 WPM/5 ERR/2 MIN
         0306      10            TYPE CENTERING PROBLEMS
         0309      10            BUILD SKILL  25 WPM/4 ERR/2 MIN
         0312      10            TYPE NUMBER AND SYMBOL KEYS  30 WPM/5 ERR/3 MIN
         0315      10            TYPE ENUMERATION PROBLEMS
         0318       8            TYPE BLOCKED LETTERS
         0321       2            CORRECT ERRORS BY ERASING
         0324       4            TYPE TABULATION PROBLEMS
         0327      15            BUILD SKILL  30 WPM/5 ERR/4 MIN

 1200                            BUSINESS RECORDS

         1203       5            PREPARE GENERAL BANK RECORDS
         1206       5            IDENTIFY BASIC TERMS & CONCEPTS OF BUSINESS DATA PROCESSING

 1500                            TELEPHONE TECHNIQUES

         1503       5            IDENTIFY CORRECT TELEPHONE PROCEDURES/TECHNIQUES/SERVICES

 1800                            JOB EXPLORATION

         1803       3            IDENTIFY JOB OPPORTUNITIES FOR BEGINNING OFFICE WORKERS
         1806       3            CONTRAST THE TWO TYPES OF INTERNAL ORGANIZATION STRUCTURES
         1809      12            COMPLETE GENERAL CLERICAL SIMULATION
         1812      12            COMPLETE SECRETARIAL/STENOGRAPHIC SIMULATION
         1815       4            COMPLETE ACCOUNTING/DATA PROCESSING SIMULATION

 2100                            EMPLOYABILITY SKILLS

         2103       5            COMPLETE STEPS IN THE EMPLOYMENT PROCESS
         2106       3            RECOGNIZE POSITIVE JOB ATTITUDES
         2109       3            SOLVE HUMAN RELATIONS PROBLEMS

 2400                            MATH COMPUTATIONS/MACHINES

         2403      15            OPERATE A TEN-KEY ADDING MACHINE
         2406      15            OPERATE AN ELECTRONIC PRINTING CALCULATOR
         2409      10            OPERATE AN ELECTRONIC DISPLAY CALCULATOR

 2700                            FILING AND RETRIEVING

         2703      20            FILE NAMES ALPHABETICALLY
         2706       5            FILE CORRESPONDENCE ALPHABETICALLY AND CHRONOLOGICALLY
         2709       5            RETRIEVE CORRESPONDENCE
         2712      10            FILE MATERIALS NUMERICALLY
```

Document Title:	"Task Listings By Program"
Purpose:	Lists tasks required for program completion
Level:	Program (or course) level document
Frequency:	As needed - up dated annually
Primary User(s):	Student, advisory committee, outside agencies

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Monitoring Individual And Class Progress

Many instructors shy away from implementing true "mastery learning" because they fear they will never be able to keep sufficient "control" of the students or that they will be swamped by a flood of paperwork.
It is relatively easy to keep control of an entire group of students when the entire class is moving from one topic or chapter to the next. However, when each individual student may progress at a different rate, the record keeping becomes more crucial.

In the competency-based approach used at SPVTI, the competencies themselves exert much of the control of student activities. By control, we mean that the students at SPVTI know two things:

1. To sucessfully complete the program and enter the work force, the competencies on the task listing must be mastered at an identified level of proficiency and
2. To remain in good standing the student must continue to make reasonable progress toward mastering the tasks.

In the traditional fixed time, lock-step method, we focus more on managing and on controlling instruction through semesters and terms and periods and arbitrary time blocks. In CBVE we focus on managing learning by setting high standards, defining the competencies to be attained and insisting that students make every reasonable effort to learn.

Implementing the competency-based approach will definitely require some new approaches to record keeping. Monitoring individual and class progress in CBVE is different than monitoring progress in the traditional approach--not necessarily harder!

SPVTI's computerized management systems keeps track of both individual and class progress through the use of the following print-outs:

1. Student progress chart
2. Student progress report
3. Progress summary report

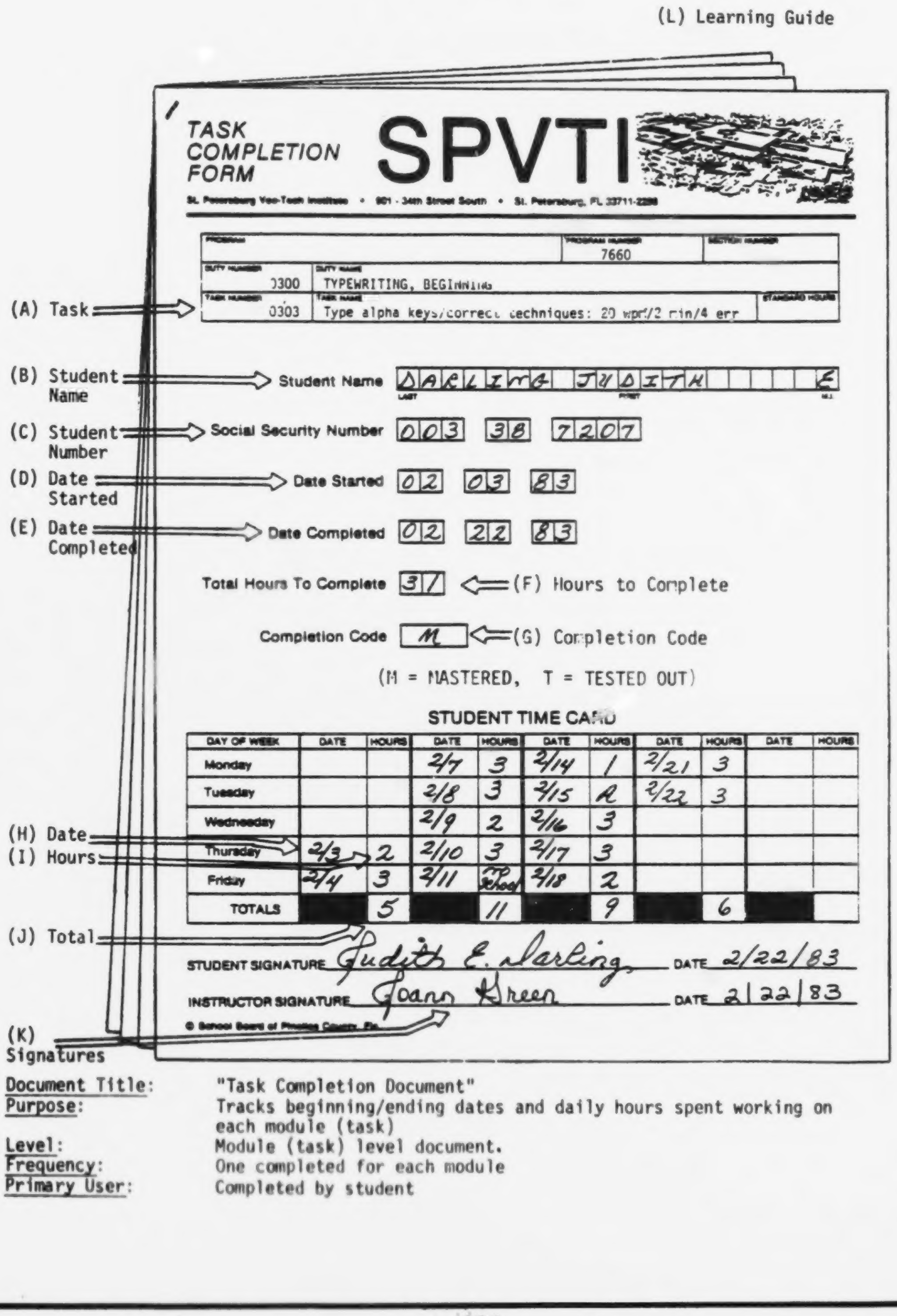
Before we examine each of these tools, we need to take a look at how data is gathered from students to generate these print-outs.
This is done by using a Task Completion Document.

Task Completion Document

On the following page is a sample of a Task Completion Document. A copy is attached to each instructional module or a copy is picked up by the student at the time he or she begins working on a new module. The students fill out the Task Completion Documents as they progress through each module. There is a learning guide for each competency on the task listing.
Examine the sample Task Completion Document and notice the following data:

(A) Task - this matches the task as found on the task listing and on the cover page of the module for which this document is being used.

D-2


(L) Learning Guide
(A) Task
(B) Student Name
(C) Student Number
(D) Date Started
(E) Date Completed
(F) Hours to Complete
(G) Completion Code
(H) Date
(I) Hours
(J) Total
(K) Signatures

TASK COMPLETION FORM

SPVTI

St. Petersburg Voc-Tech Institute • 901 - 34th Street South • St. Petersburg, FL 33711-2298

PROGRAM	PROGRAM NUMBER 7660	SECTION NUMBER
DUTY NUMBER 0300	DUTY NAME TYPEWRITING, BEGINNING	
TASK NUMBER 0303	TASK NAME Type alpha keys/correct techniques: 20 wpm/2 min/4 err	STANDARD HOURS

Student Name DARLING JUDITH E
LAST FIRST M.I.

Social Security Number 003 38 7207

Date Started 02 03 83

Date Completed 02 22 83

Total Hours To Complete 31

Completion Code M

(M = MASTERED, T = TESTED OUT)

STUDENT TIME CARD

DAY OF WEEK	DATE	HOURS	DATE	HOURS	DATE	HOURS	DATE	HOURS	DATE	HOURS
Monday			2/7	3	2/14	1	2/21	3		
Tuesday			2/8	3	2/15	A	2/22	3		
Wednesday			2/9	2	2/16	3				
Thursday	2/3	2	2/10	3	2/17	3				
Friday	2/4	3	2/11	No School	2/18	2				
TOTALS	■	5	■	11	■	9	■	6	■	

STUDENT SIGNATURE Judith E. Darling DATE 2/22/83

INSTRUCTOR SIGNATURE Joann Green DATE 2/22/83

© School Board of Pinellas County, Fla.

Document Title:	"Task Completion Document"
Purpose:	Tracks beginning/ending dates and daily hours spent working on each module (task)
Level:	Module (task) level document.
Frequency:	One completed for each module
Primary User:	Completed by student

(B) Student - the student working on this task writes in his/her name.

(C) Student number - the student adds his/her student number (social security no.)

(D) Date started - the student enters the date they actually began working on module (Feb. 3, 1983 in our example)

(E) Date completed - when the module is successfully completed, the completion date is entered.

(F) Hours to complete task - in this space the student enters the total number of clock hours actually spent on this module. This figure is determined by adding up the total in the "Student Time Sheet" section as explained below.

(G) Completion code - the appropriate code is entered depending on whether the task was mastered (M) or challenged by testing out (T).

(H) Date - here the student enters the calendar date (e.g. 2/3, 2/4 etc. of each day Mon - Fri) that is spent working on this task.

(I) Hours - the actual class hours spent working on this task each day is entered (e.g. 2 hours were spent on Thursday, February 3, working on task 0303).

(J) Total - the weekly total is entered at the end of each week.

(K) Signatures - when the form is completed, both instructor and student must sign it, signifying its accuracy.

(L) Learning Guide (Module) the Task Completion Document is attached to the module.

It is important to note that filling out the Task Completion Document is the student's responsibility - not the instructor's.

The Task Completion Document (TCD) is collected and information is entered into the computer when a student completes a module.

Student Progress Chart

Data collected from the TCD's is used to generate several printouts. One of these is the Student Progress Chart. This document measures the individual student progress against standard or average hours.
We expect the student to complete approximately nine weeks of standard hours work in each nine week period. For example, if the student was enrolled in the cosmetology program for 6 hours a day, 5 days a week for 9 weeks, that represents 270 hours available for learning. We then hold the student accountable for completing 270 hours of competencies during a nine week period. If a student successfully completes less than the 270 hours of work one of the following is probably happening.

1. The student is excessively absent.
2. The student is often tardy or leaves early.
3. The student is not giving his/her best effort.
4. The student has some serious learning handicap or lacks the necessary basic skills to benefit from the instruction.

This information allows the instructor to provide counseling and/or additional help.

Student Progress Report
The student progress report is used to record student progress information showing competencies mastered, date began and date completed.
It summarizes for a given student the information from all Task Completion Documents submitted to date. Note the sample Student Progress Report for Judith Darling on the following page.

(A) Start Date - this is the date entered originally on the Task Completion Document - indicating the date the student began workin on that particular task.

(B) Completion Date - This is the date each task was completed.

(C) Task Number - The task number from the task listing.

(D) Standard Hours - The standard (or average) hours assigned to that task.

(E) Actual Hours - The total number of class hours the student actually spent working on each task. Notice that sometimes the student's actual time is more or less than the standard hours depending on individual progress rate.

(F) Task - The task as it appears on the task listing.

(G) Mastery Code - Whether the task was "mastered" or "tested out" at the date of this printout.

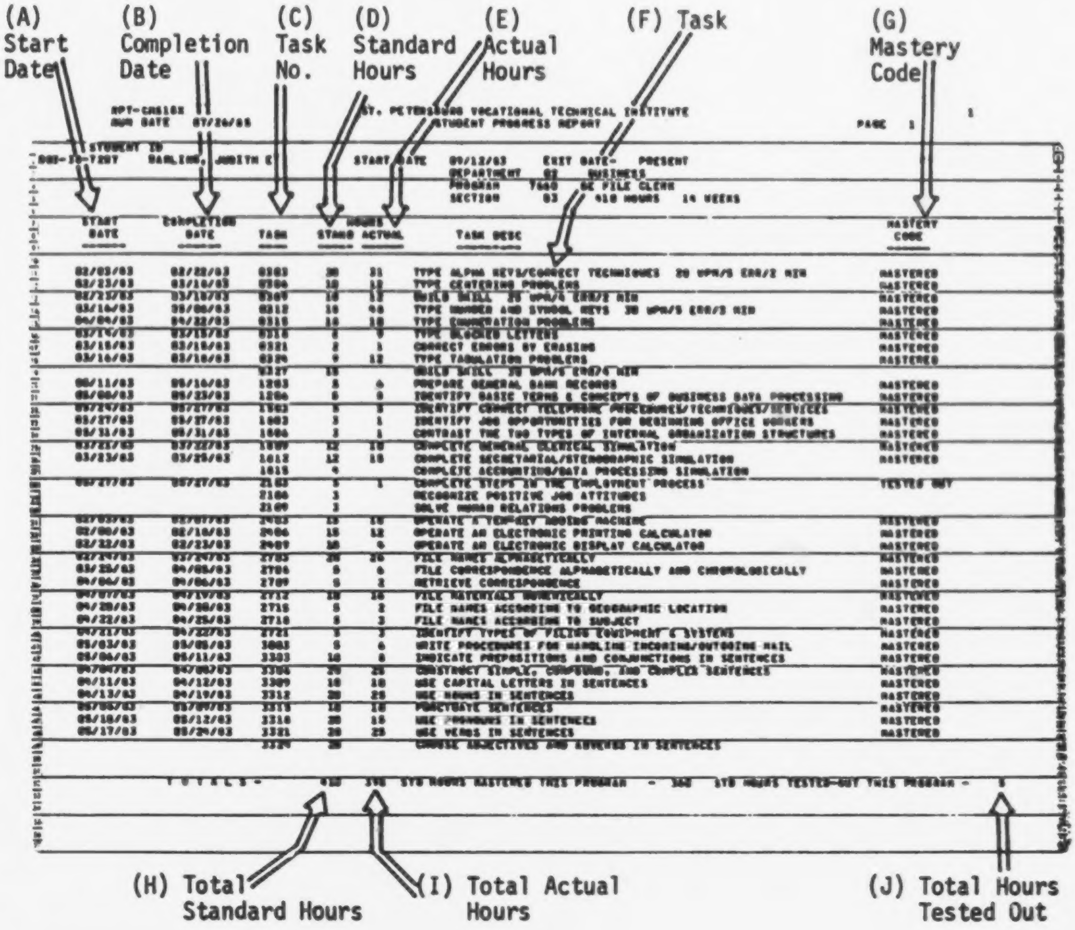
(H) Total Standard Hours - Represents the length of the training program.

(I) Total Actual Hours - Represents a total of the actual number of class hours the student spent working on tasks.

(J) Standard Hours Tested Out - Represents total number of hours which students with prior knowledge received credit for tasks when they successfully passed the post test without completing the learning activities in the module. See Example I - C.

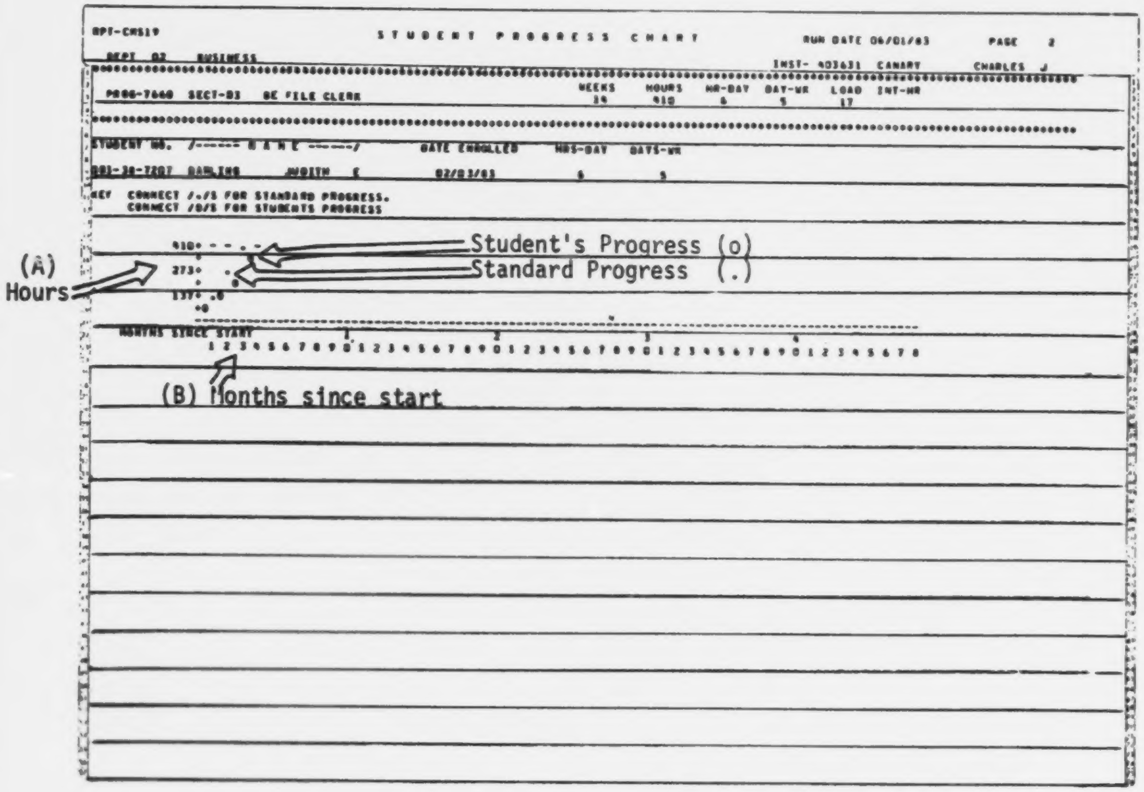
Student Progress Chart
In addition, the individual student progress can be shown graphically in relationship to the length of the program. Please note sample attached. See Example I - D.

I - C


(A) Start Date
(B) Completion Date
(C) Task No.
(D) Standard Hours
(E) Actual Hours
(F) Task
(G) Mastery Code
(H) Total Standard Hours
(I) Total Actual Hours
(J) Total Hours Tested Out

Document Title: Student Progress Report
Purpose: Indicates current status of each program for individual student
Level: Student
Frequency: As needed
Primary User: Student

I - D



```
RPT-CHS19              S T U D E N T   P R O G R E S S   C H A R T          RUN DATE 06/01/83       PAGE    2
  DEPT  02   BUSINESS
                                                                      INST- 403631  CANARY          CHARLES  J
 PROG-7660  SECT-03   BE FILE CLERK                              WEEKS    HOURS   HR-DAY  DAY-WK   LOAD  INT-WK
                                                                   24      410      6       5       17
STUDENT NO.  /------ N A M E ------/        DATE ENROLLED     HRS-DAY   DAYS-WK
001-38-7207  DARLING       JUDITH   E          02/03/83          6          5
KEY   CONNECT /./S FOR STANDARD PROGRESS.
      CONNECT /O/S FOR STUDENTS PROGRESS
```

410+
273+
137+
+0
MONTHS SINCE START
1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8
Student's Progress (o)
Standard Progress (.)
(A) Hours
(B) Months since start

<u>Document Title</u>:	Student Progress Chart
<u>Purpose</u>:	Reports student's progress to date vs. average progress
<u>Level</u>:	Student
<u>Frequency</u>:	(Monthly) or as needed
<u>Primary User</u>:	Instructor

Progress Summary Report

In addition to monitoring each individual student's progress, instructors in competency-based programs are also interested in reviewing progress of the class. At SPVTI, this is accomplished by using the Progress Summary Report. This document prints essential progress data about all students in a class.

Look at the sample Progress Summary Report found on the next page and notice the following information.

(A) Student Numbers - This first column contains the student number.

(B) Student Names - The second column lists the student name.

(C) Month - This is the space on the printout which displays progress during a three month period.

(D) Mastery Hours - Under each month's heading, there are three entries. The first is the number of mastery hours successfully completed by that student during that particular month. For example, in April 1983, J. Darling successfully completed 103 hours of competencies.

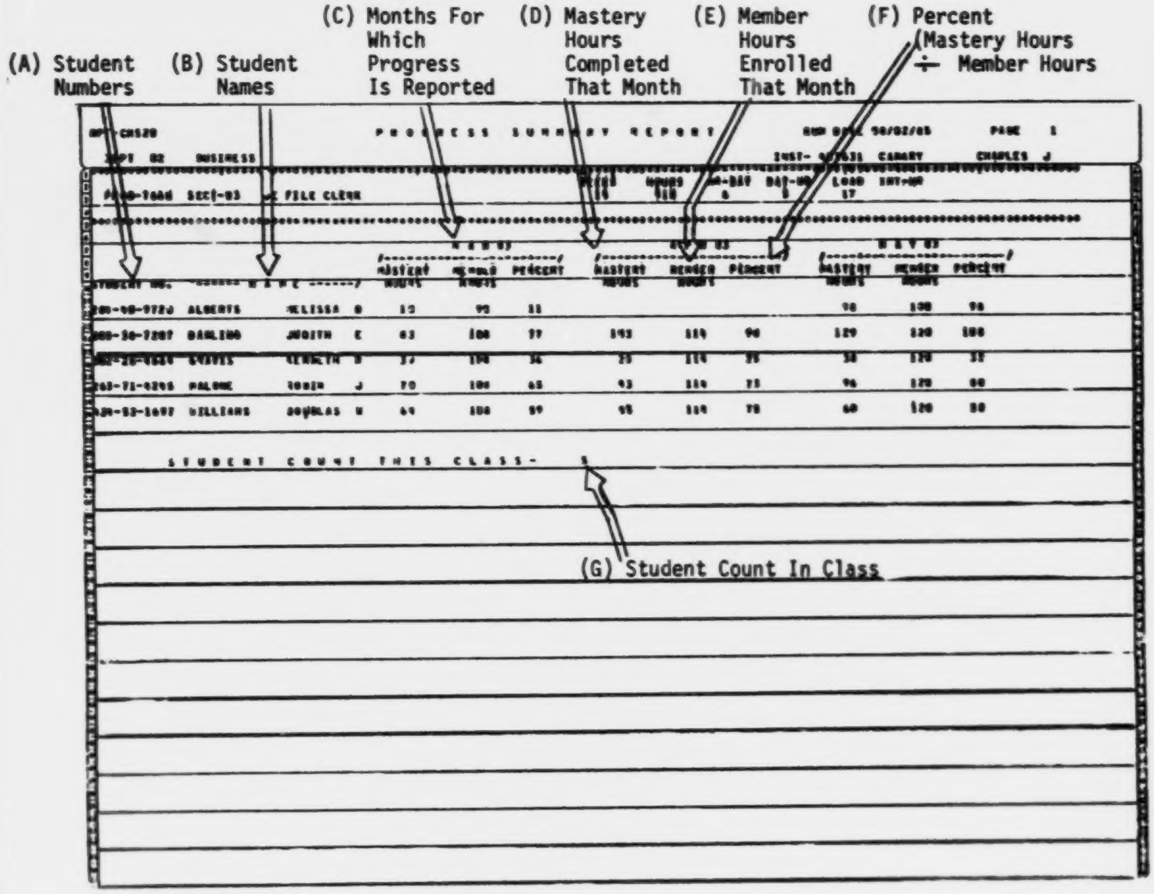
(E) Member Hours - The second column under each month is the number of hours the student was enrolled. J. Darling was enrolled for 114 hours during April.

(F) Percent - Dividing mastery hours by member hours yields a percentage which is listed in the third column under each month. Following our example, we find that K. Gravis successfully completed competency hours totaling 90% of the total hours enrolled.

(G) Student Count - Number of students for which data is being reported.

The Progress Summary Report can be reviewed each month and the instructor can quickly spot any student who seems to be having major difficulty.

D-2


(A) Student Numbers
(B) Student Names
(C) Months For Which Progress Is Reported
(D) Mastery Hours Completed That Month
(E) Member Hours Enrolled That Month
(F) Percent (Mastery Hours ÷ Member Hours
PROGRESS SUMMARY REPORT
STUDENT COUNT THIS CLASS- 5
(G) Student Count In Class

Document Title: Progress Summary Report
Purpose: Indicates percent of standard progress made by each member of class during a three month period
Level: Class
Frequency: Monthly
Primary User: Instructor

Task Mastery Documents

Two documents that are used in the SPVTI management systems to record student task mastery are:

1. Task Masteries Report
2. Student Transcript

Task Masteries Report

The Task Masteries Report is used to report important information about the student mastery of program tasks. It shows how well the group as a whole did in terms of the time spent mastering each task. Remember, in the competency based approach we are holding a high level of proficiency constant with time as the variable.
Examine the sample Task Masteries Report on the next page and you will see the following data:

(A) Standard Hours - Hours assigned

(B) Minimum Hours - In this column is listed the minimum number of hours taken by any student currently enrolled to successfully complete each task. This does not reflect students who "tested out."

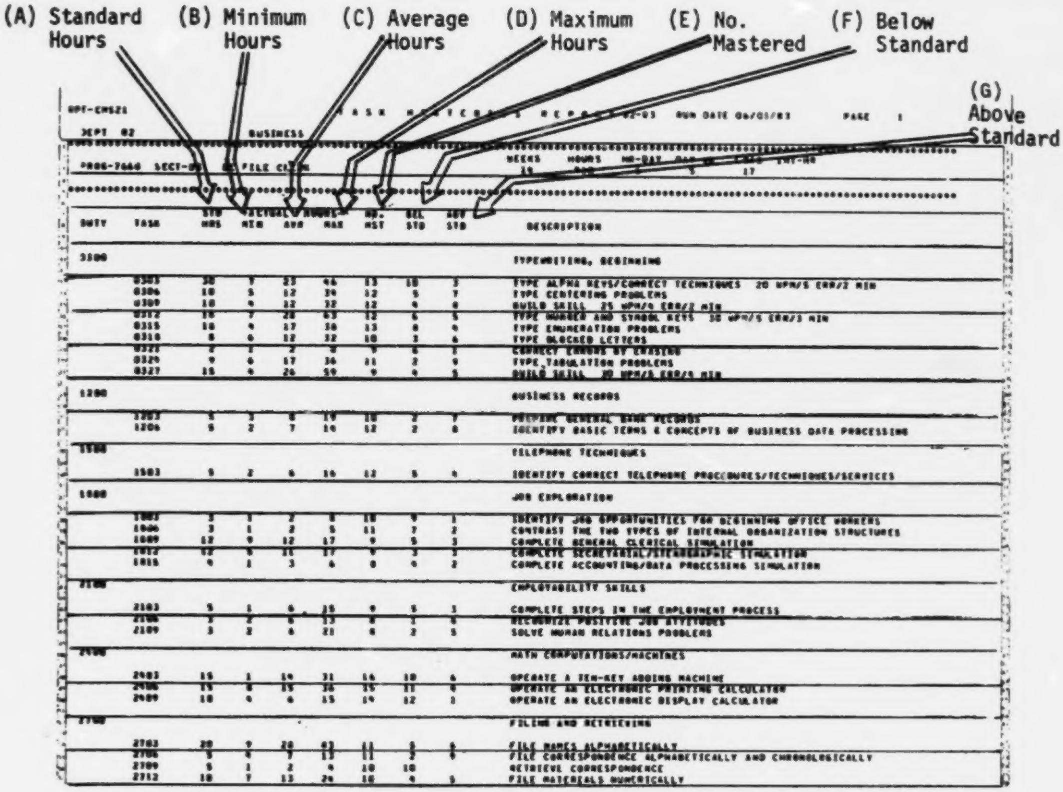
(C) Average Hours - In this column is listed the average time taken to complete each task by the current group of students. Notice that it may vary from the previously computed "standard hours." This information is used to recompute standard hours for each task.

(D) Maximum Hours - In this column we find the maximum number of hours taken by any student in the group to master each task.

(E) Number of Masteries - This figure represents the total number of students in the current program who have successfully mastered each task.

F) Below Standard - Number of current students completing tasks in less than standard time.

(G) Above Standard - Number of current students completing tasks in more than standard time.


(A) Standard Hours
(B) Minimum Hours
(C) Average Hours
(D) Maximum Hours
(E) No. Mastered
(F) Below Standard
(G) Above Standard

Document Title:	Task Masteries Report
Purpose:	Lists number of students in current class having mastered each program task; includes minimum, maximum and average time taken for mastery.
Level:	Class
Frequency:	As needed
Primary User:	Instructor

Student Transcript

A transcript may be provided for each student. It "officially" documents and certifies to employers, other schools, sponsoring agencies, which program competencies have been successfully mastered.

A review of the sample Student Transcript on the next page reveals the following information:

(A) Student Name

(B) Enrollment Period - Listed is initial enrollment date and exit date.

(C) Exit Code - Identifies reason for student leaving program.

(D) Program Name

(E) Standard Program Length

(F) Average Hours - Standard hours assigned to each task

(G) Task Name

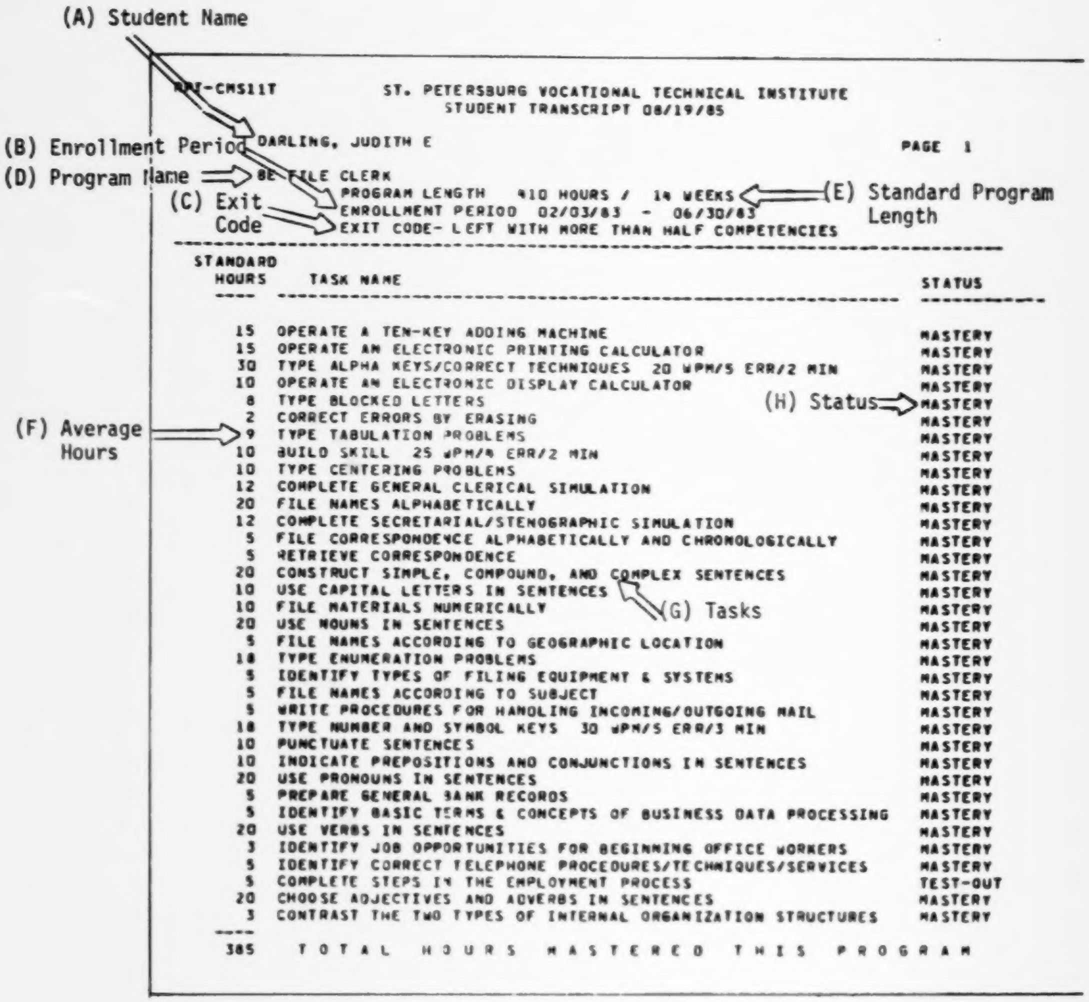
(H) Status - The status of each task listed on the transcript includes either:

1. Mastery or
2. Tested out

The Student Transcript can be generated at any time but is most often requested for the following reasons:

1. Successful completion of the program
2. Early exit
3. Transfer to a similar program
4. Seeking advanced standing at a community college at some later date

Notice how much clearer the SPVTI transript is than one that might list "courses" completed such as "Accounting 101" or "Basics of Education." The transcript reveals precisely what the student has attained in terms understandable to others.


(A) Student Name
(B) Enrollment Period
(D) Program Name
(C) Exit Code
(E) Standard Program Length
(F) Average Hours
(H) Status
(G) Tasks

```
-CMS11T           ST. PETERSBURG VOCATIONAL TECHNICAL INSTITUTE
                          STUDENT TRANSCRIPT 08/19/85

DARLING, JUDITH E                                                    PAGE  1
8E FILE CLERK
     PROGRAM LENGTH    410 HOURS /  14 WEEKS
     ENROLLMENT PERIOD  02/03/83  -  06/30/83
     EXIT CODE- LEFT WITH MORE THAN HALF COMPETENCIES
---------------------------------------------------------------------------------
STANDARD
 HOURS   TASK NAME                                                       STATUS
 ----  ---------------------------------------------------------------  -----------

  15   OPERATE A TEN-KEY ADDING MACHINE                                  MASTERY
  15   OPERATE AN ELECTRONIC PRINTING CALCULATOR                         MASTERY
  30   TYPE ALPHA KEYS/CORRECT TECHNIQUES  20 WPM/5 ERR/2 MIN            MASTERY
  10   OPERATE AN ELECTRONIC DISPLAY CALCULATOR                          MASTERY
   8   TYPE BLOCKED LETTERS                                              MASTERY
   2   CORRECT ERRORS BY ERASING                                         MASTERY
   9   TYPE TABULATION PROBLEMS                                          MASTERY
  10   BUILD SKILL  25 WPM/4 ERR/2 MIN                                   MASTERY
  10   TYPE CENTERING PROBLEMS                                           MASTERY
  12   COMPLETE GENERAL CLERICAL SIMULATION                              MASTERY
  20   FILE NAMES ALPHABETICALLY                                         MASTERY
  12   COMPLETE SECRETARIAL/STENOGRAPHIC SIMULATION                      MASTERY
   5   FILE CORRESPONDENCE ALPHABETICALLY AND CHRONOLOGICALLY            MASTERY
   5   RETRIEVE CORRESPONDENCE                                           MASTERY
  20   CONSTRUCT SIMPLE, COMPOUND, AND COMPLEX SENTENCES                 MASTERY
  10   USE CAPITAL LETTERS IN SENTENCES                                  MASTERY
  10   FILE MATERIALS NUMERICALLY                                        MASTERY
  20   USE NOUNS IN SENTENCES                                            MASTERY
   5   FILE NAMES ACCORDING TO GEOGRAPHIC LOCATION                       MASTERY
  18   TYPE ENUMERATION PROBLEMS                                         MASTERY
   5   IDENTIFY TYPES OF FILING EQUIPMENT & SYSTEMS                      MASTERY
   5   FILE NAMES ACCORDING TO SUBJECT                                   MASTERY
   5   WRITE PROCEDURES FOR HANDLING INCOMING/OUTGOING MAIL              MASTERY
  18   TYPE NUMBER AND SYMBOL KEYS  30 WPM/5 ERR/3 MIN                   MASTERY
  10   PUNCTUATE SENTENCES                                               MASTERY
  10   INDICATE PREPOSITIONS AND CONJUNCTIONS IN SENTENCES               MASTERY
  20   USE PRONOUNS IN SENTENCES                                         MASTERY
   5   PREPARE GENERAL BANK RECORDS                                      MASTERY
   5   IDENTIFY BASIC TERMS & CONCEPTS OF BUSINESS DATA PROCESSING       MASTERY
  20   USE VERBS IN SENTENCES                                            MASTERY
   3   IDENTIFY JOB OPPORTUNITIES FOR BEGINNING OFFICE WORKERS           MASTERY
   5   IDENTIFY CORRECT TELEPHONE PROCEDURES/TECHNIQUES/SERVICES         MASTERY
   5   COMPLETE STEPS IN THE EMPLOYMENT PROCESS                          TEST-OUT
  20   CHOOSE ADJECTIVES AND ADVERBS IN SENTENCES                        MASTERY
   3   CONTRAST THE TWO TYPES OF INTERNAL ORGANIZATION STRUCTURES        MASTERY
 ----
 385    TOTAL  HOURS  MASTERED  THIS  PROGRAM
```

Document Title: Student Transcript
Purpose: Officially lists tasks mastered by student
Level: Student
Frequency: Upon exit or as requested
Primary User: Student

Administrative and Support Documents

In addition to the documents described earlier that are an integral part of St. Petersburg Vocational Technical Institute's computerized competency-based management system there are additional forms and printouts that support the smooth running of the system. The following forms are used to collect or report other information similar to that found in traditional programs.

1. Student Registration Forms
2. Class Listing
3. Master Program Listings
4. List of Instructors

A sample of each of the support documents can be found on the next four pages.

Management of data is fundamental to the control, storage and retrieval of information applicable to student performance, progress and program completion. Through the competency based management system instructors improve organization and control of the learning process. Administrators are better informed concerning the operation of programs and more efficient in the maintenance of records and the assimilation of student generated information. Students are constantly aware of their progress and can accurately project their completion dates.

The CBDMS developed at St. Petersburg Vocational Technical Institute represents the merging of a modern recordkeeping system with an innovative program development concept. It keeps vocational education operating in a "state of the art" mode.

SCHOOL BOARD OF PINELLAS COUNTY, FLORIDA   VOCATIONAL TECHNICAL & ADULT EDUCATION DEPARTMENT

STUDENT REGISTRATION FORM

(Please Print)
NAME ______________________ Last ______ First ______ Middle Initial   HOME PHONE ____________

STREET ______________________ CITY ______________ ZIP ____________

SOCIAL SECURITY NUMBER ______________ DATE OF BIRTH ______ Month ______ Day ______ Year

SEX: ☐ Male ☐ Female   AGE: ☐ 16-44 ☐ 45-64 ☐ 65+

NAME OF SCHOOL/CENTER
____
In case of emergency, contact
____
PHONE ______________________

(Check Only One)   ***See Reverse Side**
I am in enrolling in this course to:
_____ 1. learn a new trade or occupation.
_____ 2. upgrade myself in present or previous occupation.
_____ 3. I do not meet the above requirements and I understand that I must pay a fee based on the direct instructional costs.

☐ Regular/Special
☐ Veteran (GI Bill)
☐ CETA

☐ Veteran Rehab.
☐ State Rehab.
☐ High School Credit
☐ Other ______________

☐ White, not of Hispanic Origin
☐ Black, not of Hispanic Origin
☐ Hispanic
☐ Asian or Pacific Islander
☐ American Indian or Alaskan Native

Date of Entry ______________ Student Signature ______________________

407

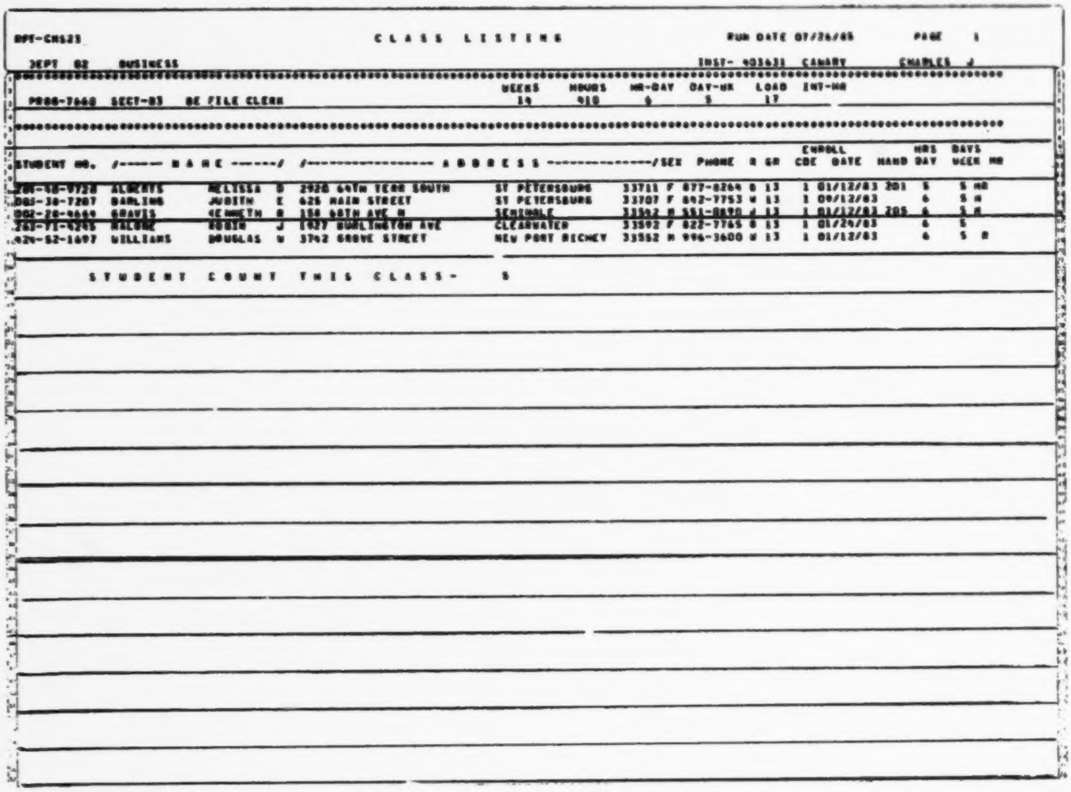
PERIOD	TIME	COURSE NO	PROGRAM/COURSE TITLE	HOURS	DAY OF WEEK	LOCATION	INSTRUCTOR

FOR OFFICE USE ONLY

FEE INFORMATION:
Amount Rec'd $ ____________ Date ________ MA RE NO
Cost Center No. ________ ☐ Cash ☐ Check ☐ Waived
Bill: ______________ (VR, CETA, VA, PA, FA)
Hours Enrolled Per Week ________
Received By: ______________________

FINAL CLASS REPORT INFORMATION
Occupational Code ____________
Grade ________ Student Membership Hrs. ________
Special Needs:
Handicapped __________ (Use Code #201-215)
Other ______________ (Use L, E or A)
Date of Termination ______________
Term. Code ________ (Refer to FCR Instruction Booklet)

PCS Form 569 (Rev. 2-83)   WHITE - VTAE OFFICE   YELLOW - CENTER   PINK - TEACHER   GOLD - STUDENT   Warehouse ID 98319



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RPT-CH523                                  C L A S S   L I S T I N G                    RUN DATE 07/26/85       PAGE    1

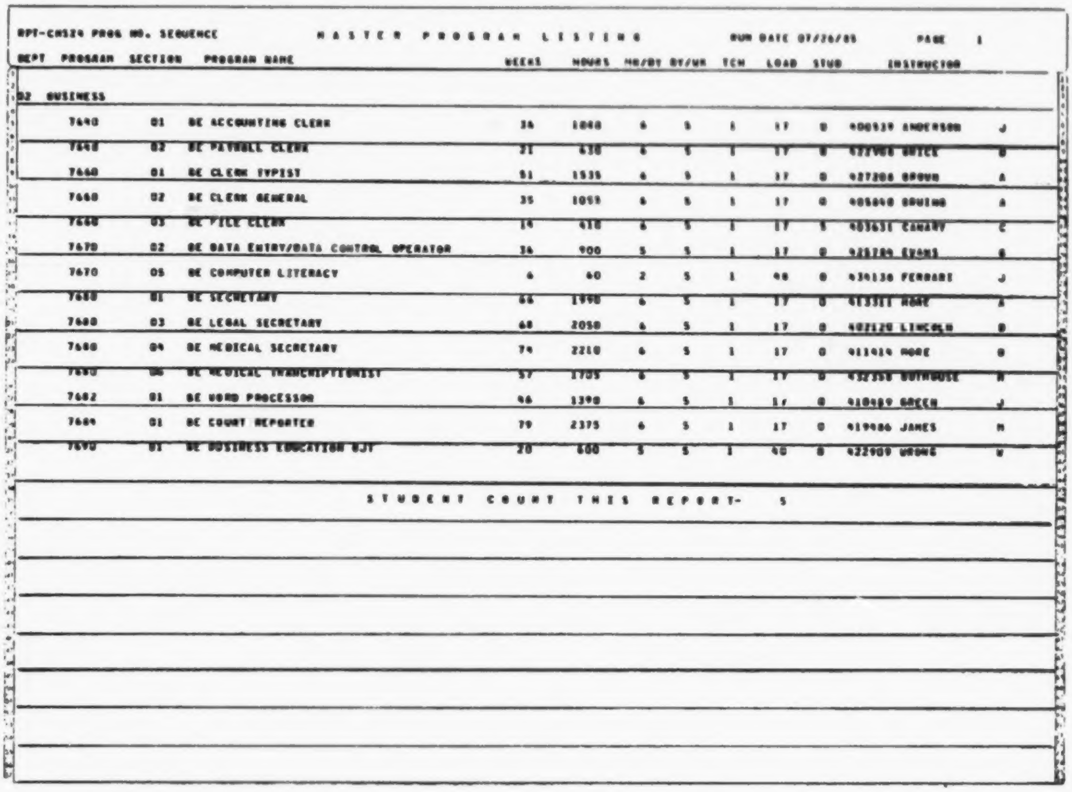
  DEPT  02    BUSINESS                                                              INST- 403631  CANARY          CHARLES  J
**************************************************************************************************************************
                                                            WEEKS     HOURS    HR-DAY  DAY-WK   LOAD  INT-HR
  PROG-7660  SECT-03   BE FILE CLERK                          19       910       6       5       17

**************************************************************************************************************************

                                                                                                  ENROLL             HRS  DAYS
STUDENT NO.  /------ N A M E ------/  /---------------- A D D R E S S ---------------/SEX  PHONE  R GR  CDE  DATE  HAND DAY  WEEK MR

261-18-9728  ALBERTS          MELISSA  D  2926 64TH TERR SOUTH    ST PETERSBURG    33711 F 877-0264 B 13   1 01/12/83 201  5     5 MR
003-38-7287  DARLING          JUDITH   E  625 MAIN STREET         ST PETERSBURG    33707 F 892-7753 W 13   1 09/12/83      6     5 M
002-28-9669  GRAVIS           KENNETH  B  158 68TH AVE N          SEMINOLE         33542 M 551-8890 J 13   1 01/12/83 205  6     5 M
263-71-4245  MALONE           ROBIN    J  1927 BURLINGTON AVE     CLEARWATER       33592 F 822-7765 B 13   1 01/24/83      6     5
424-52-1697  WILLIAMS         DOUGLAS  W  3742 GROVE STREET       NEW PORT RICHEY  33552 M 996-3600 W 13   1 01/12/83      6     5  R

         S T U D E N T   C O U N T   T H I S   C L A S S -     5
```



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RPT-CH524 PROG NO. SEQUENCE          M A S T E R   P R O G R A M   L I S T I N G          RUN DATE 07/26/85       PAGE   1
DEPT  PROGRAM  SECTION   PROGRAM NAME                              WEEKS   HOURS  HR/DY DY/WK  TCH   LOAD  STUD      INSTRUCTOR

02  BUSINESS
       7640        01    BE ACCOUNTING CLERK                         36     1080     6     5     1     17     0   400539 ANDERSON     J
       7640        02    BE PAYROLL CLERK                            21      630     6     5     1     17     0   422968 BRICE        D
       7660        01    BE CLERK TYPIST                             51     1535     6     5     1     17     0   427208 BROWN        A
       7660        02    BE CLERK GENERAL                            35     1055     6     5     1     17     0   405848 BRUINS       A
       7660        03    BE FILE CLERK                               14      410     6     5     1     17     5   403631 CANARY       C
       7670        02    BE DATA ENTRY/DATA CONTROL OPERATOR         36      900     5     5     1     17     0   425789 EVANS        G
       7670        05    BE COMPUTER LITERACY                         6       60     2     5     1     40     0   434130 FERRARI      J
       7680        01    BE SECRETARY                                66     1990     6     5     1     17     0   413311 HORE         A
       7680        03    BE LEGAL SECRETARY                          68     2050     6     5     1     17     0   402120 LINCOLN      B
       7680        04    BE MEDICAL SECRETARY                        74     2210     6     5     1     17     0   411414 MORE         D
       7680        06    BE MEDICAL TRANSCRIPTIONIST                 57     1705     6     5     1     17     0   432358 ROTHHOUSE    H
       7682        01    BE WORD PROCESSOR                           46     1390     6     5     1     17     0   410989 GREEN        J
       7684        01    BE COURT REPORTER                           79     2375     6     5     1     17     0   419986 JAMES        M
       7690        01    BE BUSINESS EDUCATION OJT                   20      600     5     5     1     40     0   422909 WRONG        W

                                    S T U D E N T   C O U N T   T H I S   R E P O R T -     5
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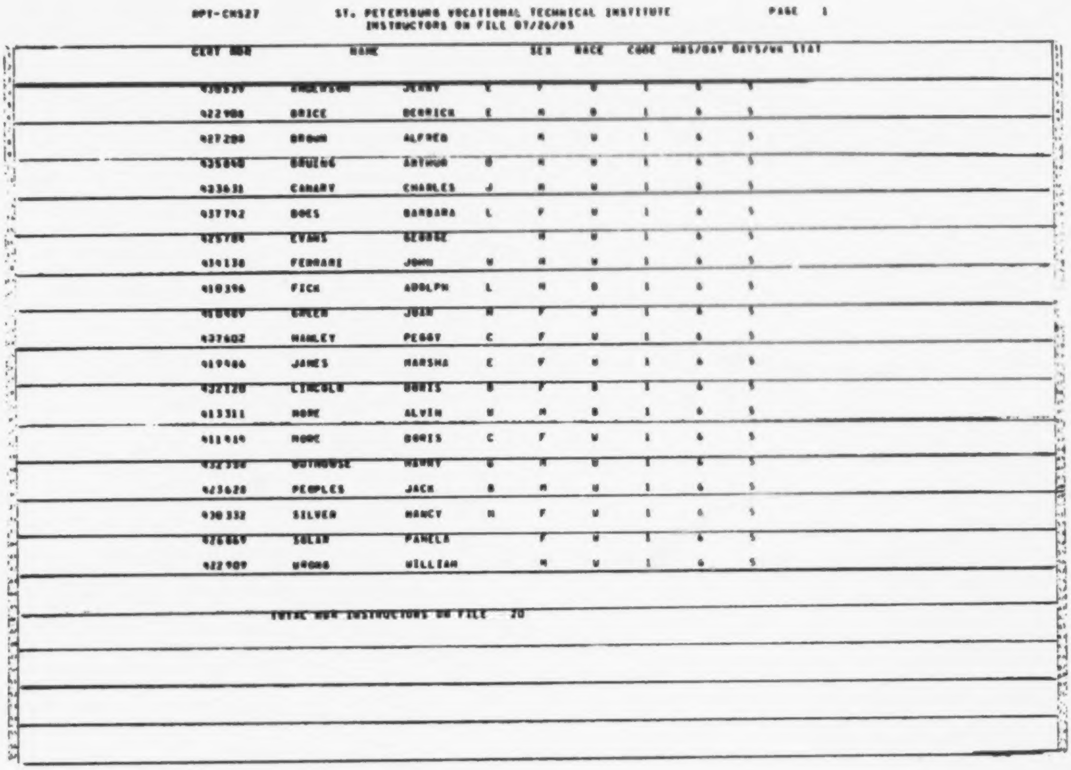
D-2



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RPT-CH527        ST. PETERSBURG VOCATIONAL TECHNICAL INSTITUTE           PAGE   1
                      INSTRUCTORS ON FILE 07/26/85

CERT NBR            NAME                      SEX   RACE   CODE  HRS/DAY DAYS/WK STAT

  430539     ANDERSON      JERRY       E       F     W      1      6      5
  422908     BRICE         DERRICK     E       M     B      1      6      5
  427208     BROWN         ALFRED              M     W      1      6      5
  435040     BRUING        ARTHUR      O       M     W      1      6      5
  433631     CANARY        CHARLES     J       M     W      1      6      5
  437742     DOES          BARBARA     L       F     W      1      6      5
  425784     EVANS         GEORGE              M     W      1      6      5
  434130     FERRARI       JOHN        W       M     W      1      6      5
  410396     FICK          ADOLPH      L       M     B      1      6      5
  418489     GREEN         JOAN        M       F     W      1      6      5
  437602     HANLEY        PEGGY       C       F     W      1      6      5
  419466     JAMES         MARSHA      E       F     W      1      6      5
  432120     LINCOLN       DORIS       B       F     B      1      6      5
  413311     MORE          ALVIN       W       M     B      1      6      5
  411419     MORE          DORIS       C       F     W      1      6      5
  432358     OUTHOUSE      HENRY       G       M     W      1      6      5
  423620     PEOPLES       JACK        B       M     W      1      6      5
  430332     SILVER        NANCY       N       F     W      1      6      5
  426669     SOLAR         PAMELA              F     W      1      6      5
  422909     WRONG         WILLIAM             M     W      1      6      5

            TOTAL NBR INSTRUCTORS ON FILE   20
```

Staff Development

The real key to an effective competency-based education program is the instructional staff who is actively involved with students on a day to day basis. Facilities, tools, learning guides, training aids etc. are all important but in order for CBE to succeed a trained and qualified staff is necessary. Many schools have spent thousands of dollars on materials and equipment and nothing on staff development and wondered why their CBE implementation effort was not successful. A well thought-out and carefully planned staff development program is absolutely essential. Competency-based education requires instructors to have expertise in a variety of skills and without this expertise, competency-based education will not operate effectively.

The staff development program at your particular institution will be dependent on several factors including the present level of expertise of the staff and the scope of the implementation effort. The instructor/staff development program should be competency-based. In other words, specific tasks need to be identified and instructors/staff should be required to demonstrate mastery. Avoid general pedagogy theory courses and concentrate on mastery of specific skills (i.e. write a performance objective, develop a task listing, etc.).

As you recall from Component B of the Resource Guide the first step in developing a competency-based training program is to identify essential skills. An instructor/staff development training program should be based on the same philosophy (identify essential tasks). Once your competency-based system of learning has been identified you should list the skills instructors would need to implement the system. The number of tasks you identify will be dependent on the complexity of the implementation effort and the current expertise of the staff. (Review page 127 for suggestions)

Several schools and organizations have designed staff development programs that are directed to competency-based education. Although some of these instructor training programs are designed for a specific institution, much useful information can be obtained by reviewing them.

Sources of Staff Development Materials

Performance-Based Teacher Education Modules
American Association for Vocational Instructional Materials
120 Engineering Center
Athens, Georgia 30602
404-542-2568

Texas State Technical Institute-Amarillo,Harlingen,
Sweetwater, Waco

Competency-Based Individualized Vocational
Educational Consortium (CIVEC)
301 N. Swift Road
Addison, Illinois 60101
312-620-8770

Ridge Vo-Tech Center
7700 State Road 544N
Winter Haven, Florida

Northeast Metro Tech
3300 Century Avenue North
White Bear Lake, Minnesota 55110

TSTI Harlingen recently conducted a task survey of instructors who are currently using competency-based education. The results of this survey are included in the resource section of this component.

Student Orientation

If students are to receive the maximum benefits of competency-based education they must understand the system. The best method to achieve this goal is to develop a comprehensive student orientation program. The contents of the student orientation program will be determined by the complexity of the school's/program's CBE implementation effort.

Most students have attended schools that used traditional teaching techniques and delivery methods and are probably not familiar with CBE. Students need to understand the difference between a traditional system and a competency-based one.

Normally student orientation is addressed at two levels: the school level and the program level. Topics covered at the school level could include campus facilities and resources, school policies and procedures, student support services, financial aid and an overview of competency-based education. If a school has adopted student learning guides, then the use of these documents should be covered . Many CBE schools have developed student learning guides that direct students through the orientation process.

Students are also oriented to the training program they have enrolled in. Often this orientation includes program practices, policies, rules, regulations, shop safety and a tour of the facilities.

Many schools have produced handbooks that are distributed to students and serve as a reinforcement and written account of what was discussed in the orientation.

The following is an example of the table of contents of a student handbook developed at Ridge Vocational Technical Center.

CONTENTS

To the Student VII
The Ridge Philosophy 1
Know Your Handbook! 1
Statement of Nondiscrimination 1
Sex Equity 1
A Competency-Based System of Learning 2
  Benefits to You! 2
  The Instructor's Role. 2
  How the CBVE System Works 3
  Tasks and Duties. 3
  Using the Student Learning Guides 4
  Time Cards. 14
  How You Are Graded at Ridge. 15
  Here's How It Works. 16
  Work Habits and Attitudes. 19
Vocational Program Credits for High School Students 22
Awards. 22
Certificates 22
Attendance and Punctuality 22
Entries, Transfers, Withdrawals. 24
Visitors. 24
Transportation 24
Exit Procedure from the Campus Parking Lot 25
Safety. 25
Other Regulations 26
Services Available to You at Ridge 27
Admissions 28
Daytime Program Offerings 28
Adult Evening Program Offerings 33

A comprehensive student orientation program explaining what competency-based education is and outlining the student's responsibilities can help assure the student's future success in a training program. Many schools also assign faculty advisors to students during orientation.

The student orientation program you design will be dependent on the complexity of your CBE program. Remember most students are not familiar with CBE and they are often used to being told exactly what they are to do, how to do it and when to do it. The content of your orientation program should be based on the skills, knowledge and attitudes necessary to function effectively in your training program.

Grading

One aspect of competency-based education implementation and management that has caused concern among many instructors is the development of a grading system. Grading in a competency-based system is usually not compatible with grading in a traditional delivery system.

Grading of students in a traditional delivery system often operates in the following manner. A student's work is evaluated and after each evaluation (test, lab sheet, exam, etc.) all students move on to the next topic regardless of the grade received. At the end of the grading period (quarter, semester) grades are averaged and a single grade is granted for a course. Often grading in a traditional system is norm referenced and a grading curve is used. Traditionally there is a reliance on written tests.

Grading in a competency-based delivery system is based on the student's ability to demonstrate competence at a high level of mastery. Evaluation is criterion referenced and each student's performance is compared to fixed criteria. Students must demonstrate mastery in each competency. In CBE the grade earned by a student is a measure of competency, based on mastery of skills, knowledge and attitudes needed on the job.

There are basically two levels of assessment in competency-based education. The first level of assessment involves the actual certification of mastery (competence) of a task. Normally an instructor would use a checklist to rate a student's performance against each of the specific criteria on the checklist.

Each item on a performance checklist is typically rated "yes" or "no" (satisfactory/unsatisfactory, pass/fail, etc.). Some schools utilize a rating system that evaluates a student's mastery of the task on a scale A-F, 1-5 etc. The following graphic is a sample of a rating scale.

5-Can perform this skill satisfactorily with initiative and adaptability to problem situations.

4-Can perform this skill satisfactorily without assistance and/or supervision.

3-Can perform this skill satisfactorily but requires periodic assistance and/or supervision.

2-Can perform parts of this skill satisfactorily but requires considerable assistance and/or supervision.

1-Has some knowledge about this skill but cannot perform the skill satisfactorily.

The second level of assessment involves assigning grades for courses (the assignment of a grade for work over a period of time, quarter, semester etc.). Many different grading systems are in use in competency-based programs. These grading systems include:

- **The number of tasks mastered during a given grading period.**
- **Pass/Fail**
- **The mastery or achievement level reached for each task.**
- **Combination of the above.**

An example of each of the above grading systems is included in the resource section of this component. An indepth look at grading systems used in competency-based educated can be found in Handbook for Developing Competency-Based Training Programs by William E. Blank, (Prentice Hall).

Attendance/Progress D-6

One misconception many instructors who are not familiar with CBE have concerning attendance and progress in a competency-based education system is that students are free to come and go as they please. In other words there is a mistaken belief that students can come to school anytime they wish and take as long as they want to complete competencies. Effective implementation of CBE requires strict attendance and progress guidelines. Employers expect workers to show up on time (attendance) and produce a certain minimum level of product or service (progress) while at work. CBE educators should expect no less.

The major difference in attendance requirements between a competency-based program (assuming learning guides are used) and a more traditional program is the flexibility of scheduling. A traditional program normally requires all students to show up at the same time because courses are offered only at specific times (i.e. MWF, 8:00-10:00 a.m.). CBE allows students to develop a schedule that best meets their individual needs. For example, a student could schedule "classes" for two hours on Monday (9:00 a.m. - 11:00 a.m.) and four hours on Thursday (1:00 p.m. - 5:00 p.m.). Both students (using the preceding example) are in attendance the same amount of time but the student in the CBE program can adjust his/her schedule to meet work needs, family commitments etc.

The resource section of Component D contains an Attendance/Progress Policy and Procedure developed at Texas State Technical Institute-Amarillo. Most instructors who have implemented competency-based education successfully have strict attendance and progress policies that require students to be in attendance at agreed upon times and demonstrate specified rates of progress.

Task Mapping

Task mapping (task sequencing) has been mentioned several times in prior components of the Resource Guide. In competency-based education students do not necessarily master the specific tasks within each duty in the sequence which these tasks are listed on the training program's official task listing simply because they are listed that way. The following example using tasks from an auto mechanics program illustrates this fact.

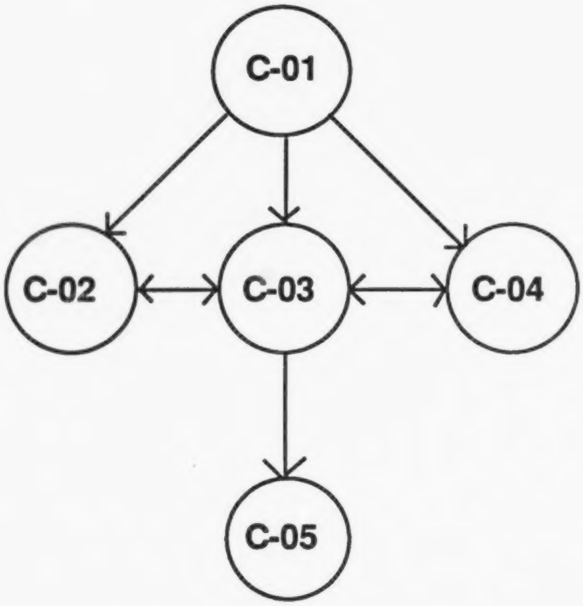
EXAMPLE: **Auto Mechanics Program**
Duty C: Maintaining Fuel System
Tasks:

- C-01: Identify and explain operation of fuel system components
- C-02: Service fuel tank and hoses
- C-03: Service carburetors.
- C-04: Service fuel pumps.
- C-05: Diagnose and repair malfunctioning fuel system.

The illustration located on the following page shows the sequence of tasks for this example. Notice that when students begin duty C they must begin with task C-01, since it is at the very top. Apparently, C-01 is prerequisite for the other tasks in that duty. Upon mastering C-01, however, notice that students have a choice about which task will be begun next-either C-02, C-03 or C-04. Notice also that these three tasks, as well as C-01, must be mastered before C-05 is begun.

Program/Occupation: **Auto Mechanics Program**

Duty: C : **Maintaining Fuel System**



C-01: Identify and explain operation of fuel system components.
C-02: Service fuel tank and hoses.
C-03: Service carburetors.
C-04: Service fuel pumps.
C-05: Diagnose and repair malfunctioning fuel system.

This example of task sequencing is taken from the Handbook for Developing Competency-Based Training Programs, by William E. Blank.

Suggestions for Sequencing Tasks

1. Sequence prerequisite tasks immediately before the task for which they are a prerequisite.

2. Sequence tasks from simple to more complex.

3. Build one task on another task that the student can already perform (remember mastery learning).

4. Sequence tasks as they are typically performed on the job.

5. Have students perform "hands on" tasks early in their enrollment. Many students get turned off by too much theory or related instruction courses.

Sequence tasks to provide exit points to suboccupations. (An automotive technology student could be employed in several suboccupations i.e. tune up, engines, brakework, etc.) and not necessarily finish "the complete" auto mechanics program. Allow training options within different specialities.

Most training programs in Texas are course based so tasks will have to be sequenced within a course. It is also recommended that courses be sequenced using the same methods described for sequencing tasks. An example of a course map is included in the resource section of this component.

Learning Guide Production/Quality Control

D-8

Most programs that have successfully implemented competency-based education have adopted student learning guides as the primary method of instructional delivery. Remember, learning guides direct students through a series of carefully selected activities that eventually lead to the mastery of a specific task. If learning guides are to accomplish that goal then they must be well designed and of high quality.

The authors of this publication strongly recommend schools adopt one student learning guide format that will be used schoolwide. Institutions that have allowed individual departments (or even in some cases individual instructors within a department) to develop their own learning guide format have had nothing but problems. Standardizing on one format is recommended for the following reasons:

Why Standardize?

√ 1. The learning guide will contain the essential elements necessary to be effective.

√ 2. Clerical staff will only have to be trained in word processing one format.

√ 3. Staff development is easier, only one manual will have to be developed on how to write learning guides.

It is also recommended that all learning guides be "typed" using a word processing or desktop publishing program. Learning guides that have been word processed are easy to update or make necessary corrections.

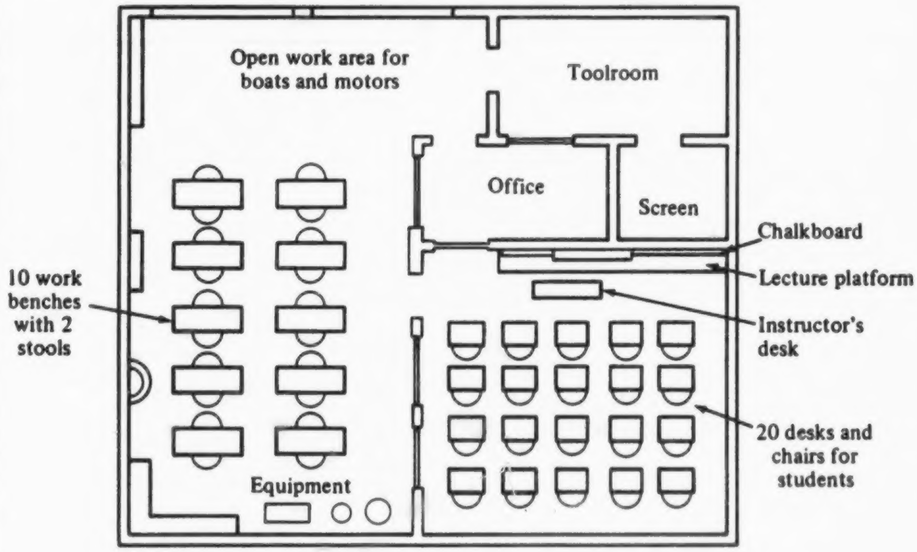
Try to have learning guides look as professional as possible. Recent innovations in desktop publishing now allow schools to produce documents of typeset quality at a fraction of what they would have cost a few years ago. In fact, the publication you are now reading (with the exception of some of the documents included in the resource sections) was produced by an Apple Macintosh Computer, a desktop publishing program (Pagemaker) and a laser printer (Apple LaserWriter).

The resource section of this component includes a learning guide quality assurance checklist developed at Ridge Vo-Tech in Winter Haven, Florida and a policy and procedure implemented at TSTI-Amarillo to assure quality in learning guides.

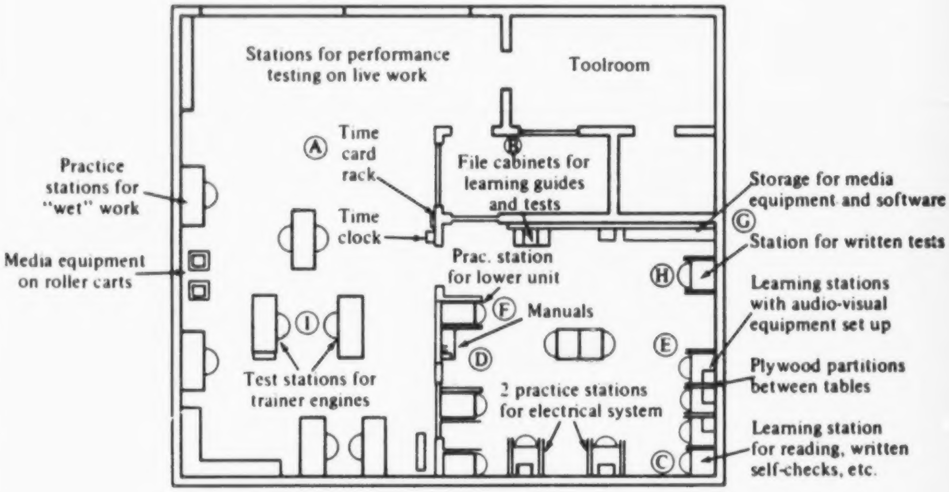
Desirable Characteristics of a Learning Resource Center

D-9

Most classrooms, laboratories and shops were designed for the traditional or conventional delivery of instruction. Classrooms often contain rows of chairs where students as a group listen to lectures, watch audio visual presentations or participate in other group oriented activities. Shops and laboratories are usually designed so that a large group can engage in some practice or skill oriented activity. In other words if twenty students are enrolled in a course there will be twenty seats in a classroom and twenty work stations in the lab. The following graphic is a typical layout of a classroom and a shop in a traditional delivery system.


Open work area for boats and motors
Toolroom
Office
Screen
Chalkboard
Lecture platform
Instructor's desk
10 work benches with 2 stools
20 desks and chairs for students
Equipment

Most vocational technical programs will not have the luxury of designing a new facility or making expensive modifications or renovations to accomodate competency-based education. The rearrangement of furniture, removal of a lecture classroom and some other minor modifications will result in an environment that is conducive to competency-based education. The graphic below illustrates how some minor modifications can drastically change the learning environment.


Stations for performance testing on live work
Toolroom
Ⓐ
Time card rack
Ⓑ
File cabinets for learning guides and tests
Practice stations for "wet" work
Storage for media equipment and software
Ⓖ
Time clock
Station for written tests
Media equipment on roller carts
Prac. station for lower unit
Ⓗ
Ⓕ
Manuals
Learning stations with audio-visual equipment set up
Ⓘ
Ⓓ
Ⓔ
Test stations for trainer engines
Plywood partitions between tables
2 practice stations for electrical system
Learning station for reading, written self-checks, etc.
Ⓒ

The preceding example illustrates with a little planning and some minor modifications a traditional classroom/shop can easily be changed to an environment that can accommodate the requirements of competency-based education. **Traditional classrooms and labs are designed for teaching, CBE facilities are designed for learning.**

The list on the next page contains desirable characteristics of a learning resource center.

Desirable Characteristics of a Learning Resource Center

An ideal learning resource center serving a CBE program:

1. Can be set up and equipped with a minimum of expense, effort and disruption of present students.

2. Makes full use of already existing space, furniture, electrical outlets, media equipment, shelves, cabinets and other items.

3. Is located as close as possible to the vocational program area it will serve to reduce the time and effort it takes students to get to and from the center.

4. Can be locked or otherwise secured to reduce vandalism, pilferage, and unauthorized use.

5. Can be monitored by the instructor, proctor, aide or other responsible person without having to leave the primary classroom or laboratory area.

6. Is organized efficiently--students' time and learning activities while in the learning center are productive with a minimum of lost motion and unnecessary waiting.

7. Is organized effectively--students engage in learning activities that help them master the program competencies.

8. Utilizes learning resources and materials that are located in easily accessible places and are clearly marked for locating and replacing.

9. Is set up so students can use it at the same time without unnecessarily interfering with one another's learning.

10. Is flexible--can accommodate a wide variety of learning activities such as reading, viewing, writing, discussing, questioning and practicing.

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CBE Instructor Task Survey (427-430)

Grading (431-442)

Attendance/Progress (443-452)

Course Mapping (453-454)

Learning Guide Quality Control (455-464)

Texas State Technical Institute Harlingen recently surveyed instructors who are currently using competency-based education. The resource on the following page is a list of tasks ranked by importance as determined by CBE instructors. The following rating system was used in this survey.

1.00- Tasks rated as having low importance are performed, but they are of minor importance and have a low priority.

2.00- Tasks rated as having medium importance are not critical, but they are often given priority over other tasks. Inadequate performance CAN seriously impact product or service.

3.00 Tasks rated high in importance are critical and have the highest priority. Inadequate performance of this task WILL have serious impact on product or services.

This resource was included to illustrate the variety of topics (tasks) that might be included in a staff development program.

Duty	Task	Task Statement	ID	AVG.
A	00	Orient student to CBE system and instructional program.	I	3.00
D	10	Use effective communication skills.	I	3.00
C	00	Evaluate student progress.	I	3.00
B	07	Develop learning guides.	I	2.92
B	06	Write performance objectives.	I	2.89
B	00	Develop curriculum and learning materials.	I	2.87
C	05	Evaluate performance/product.	I	2.85
H	07	Visit industries/operations to identify changes in the field	I	2.84
A	02	Orient student to CBE learning system.	I	2.83
F	07	Explain concepts at student's level.	I	2.82
D	09	Plan for student access to instructors.	I	2.82
B	10	Develop learning activites and exercises.	I	2.81
H	03	Maintain liaison with employing industries	I	2.80
G	01	Counsel student about progress.	I	2.79
B	04	Correlate content with tasks.	I	2.78
B	02	Use validated task listing to develop curriculum.	I	2.78
H	09	Participate in advisory committee metings & activities	I	2.78
D	06	Select Equipment, tools, and supplies.	I	2.78
C	02	Select appropriate evaluation procedures.	I	2.78
J	02	Recruit students to program.	I	2.77
H	04	Initiate employer/student contacts to potential employment.	I	2.76
A	08	Assist student in managing time.	I	2.76
F	08	Employ problem-solving techniques.	I	2.74
F	06	Facilitate student-directed learning.	I	2.72
F	01	Demonstrate a manipulative skill.	I	2.72
I	03	Identify and evaluate communication strengths & weakness	I	2.72
E	11	Detect immediate student needs.	I	2.70
C	01	Correlate evaluations with competencies	I	2.70
H	10	Recommend changes to occup. analysis & task listing	I	2.70
E	00	Guide student in a CBE learning environment	I	2.69
C	03	Explain grading system to students.	I	2.68
I	10	Maintain pace with advances in occupational speciality	I	2.68
B	01	Assist student with operating a.v. hardware.	I	2.67
D	03	Adapt training environment to reflect industrial standards	I	2.67
E	10	Provide direct feedback to students.	I	2.67
D	05	Set up and maintain resource center.	I	2.67
D	00	Establish learning environment.	I	2.67
E	14	Vary approaches to activities & projects to sustain enthusiasm & int.	I	2.65
I	02	Identify and evaluate technical strengths and weaknesses.	I	2.65
B	09	Prepare materials to link, expand or highlight materials.	I	2.65
C	14	Identify external factors causing lack of progress.	I	2.65
E	13	Assist student in recognizing his own achievements.	I	2.64
F	05	Utilize individualized instruction material.	I	2.64
J	07	Requisition equipment, supplies, and materials.	I	2.64
F	11	Direct student laboratory.	I	2.64
J	01	Implement program's student recordkeeping system.	I	2.64
B	08	Select resource materials.	I	2.63
C	08	Asses problem-solving skills.	I	2.63
F	14	Use models and real objects.	I	2.63
I	01	Identify and evaluate personal strengths and weaknesses.	I	2.62
G	06	Assess attitudes by observation	I	2.62
F	00	Utilize teaching/learning strategies.	I	2.62
G	02	Assist student in planning job search and occupation entry	I	2.60
D	08	Maintain training aids, equipment and simulators	I	2.59
G	05	Determine student problem areas.	I	2.59
C	06	Relate rating to industrial performance.	I	2.58
B	05	Develop course syllabus	I	2.58

E	08	Assist student in establishing occupational thought process	I	2.58
D	02	Promote student application of technical vocabulary.	I	2.58
I	07	Initiate and maintain professional contacts.	I	2.58
C	13	Recognize inaccurate ratings and request repeat performances	I	2.56
E	12	Assist student in recognizing relevance of activities to goals.	I	2.56
H	05	Follow up former students to assess program effectiveness	I	2.54
J	06	Maintain inventory	I	2.54
A	05	Orient student to the program grading system	I	2.52
H	02	Identify employment opportunities	I	2.52
D	04	Plan layout of classrooms and laboratories.	I	2.50
J	10	Recommend adjustments or changes within program.	I	2.50
H	00	Interact with the community.	I	2.50
E	05	Assist student in initiating use of self-instruction materials.	I	2.50
D	07	Integrate storage, control of tools, equipment and material.	I	2.50
B	03	Recommend changes to occupation analysis and task listing.	I	2.50
B	13	Analyze student performance to determine need for material.	I	2.50
C	10	Evaluate teaching strategy.	I	2.48
B	11	Summarize and reconstruct printed materials.	I	2.48
D	01	Establish supervisor/employee relationship with student.	I	2.48
C	09	Evaluate examination effectiveness.	I	2.48
A	06	Assist student in establishing priorities and goals.	I	2.48
I	14	Apply first-aid procedures	I	2.48
I	08	Attend professional conferences.	I	2.48
F	04	Employ oral questioning.	I	2.46
A	03	Orient student to program and institutional resources.	I	2.46
I	00	Develop personal competencies.	I	2.45
E	02	Assist student in locating and analyzing samples of work.	I	2.44
G	00	Perform counseling/advising of students.	I	2.43
I	13	Contribute to staff meetings.	I	2.43
A	01	Orient student to occupational choices within chosen field.	I	2.42
B	12	Sketch charts, diagrams and schematics.	I	2.40
J	00	Perform administrative duties.	I	2.40
J	09	Participate in on-going departmental operations.	I	2.39
I	04	Prepare a personal professional growth plan annually.	I	2.38
J	03	Conduct intake interviews.	I	2.37
G	09	Assist student with learning prescriptions.	I	2.35
J	12	Perform student disciplinary functions.	I	2.35
J	04	Participate in student placement and follow-up.	I	2.35
I	09	Review professional journals.	I	2.35
G	03	Assist student in personal interest and skill profile to jobs.	I	2.33
C	07	Evaluate student inter-personal skills.	I	2.32
G	10	Direct students to campus support services.	I	2.31
E	04	Assist student in initiating use of reference materials.	I	2.31
G	07	Counsel student to assess situations and determine actions.	I	2.30
B	19	Prepare models and mockups.	I	2.30
A	07	Assist student in planning personal route through tasks.	I	2.29
F	02	Conduct a small-group session.	I	2.29
C	15	Monitor student's progress in related subjects.	I	2.29
H	01	Participate in program public relations activities.	I	2.26
C	11	Utilize student self-rating.	I	2.21
I	11	Perform site visits.	I	2.20
B	01	Utilize community and state employement needs data.	I	2.20
J	09	Attend required meetings and functions.	I	2.19
J	05	Prepare letters of reference for students.	I	2.18
J	13	Fulfill institutional committee assignments.	I	2.17
I	06	Participate in professional organizations.	I	2.16
E	09	Assist students in developing learning plans.	I	2.16
F	03	Conduct a large-group lecture	I	2.14
G	04	Detect student reaction to institute and program.	I	2.13
B	17	Prepare videotapes.	I	2.11

E	06	Assist student in determining when he has adequate information	I	2.10
J	14	Supervise support personnel.	I	2.10
F	09	Utilize subject matter experts.	I	2.09
A	04	Orient student to the program's task flowchart.	I	2.09
B	20	Develop computer-based training materials	I	2.06
C	12	Utilize assessments of students made by instructors.	I	2.06
H	08	Conduct informal community needs assessment.	I	2.05
E	07	Assist student in taking info-gathering notes and records.	I	2.05
E	03	Assist student in selecting from several information options	I	2.05
H	06	Assist employers in planning and providing training programs	I	2.05
I	05	Participate in in-service activities.	I	2.04
G	08	Assist student with personal problems.	I	2.00
I	12	Attend trade shows.	I	2.00
H	11	Demonstrate technique/concepts in workshops open to public.	I	2.00
F	13	Use the chalkboard.	I	2.00
G	12	Direct students to financial aid information.	I	2.00
F	12	Use media presentations.	I	1.95
B	18	Prepare slide presentation.	I	1.89
B	16	Prepare audiotapes.	I	1.89
B	15	Prepare computer-assisted materials	I	1.89
C	04	Pretest students.	I	1.80
F	15	Prepare exhibits.	I	1.79
G	11	Counsel student jointly with counseling staff.	I	1.76
F	10	Conduct off-campus laboratory activities.	I	1.69
J	11	Advise student organizations.	I	1.63
B	21	Utilize authoring systems to develop course software.	I	1.62
B	14	Prepare transparencies.	I	1.52

D-10

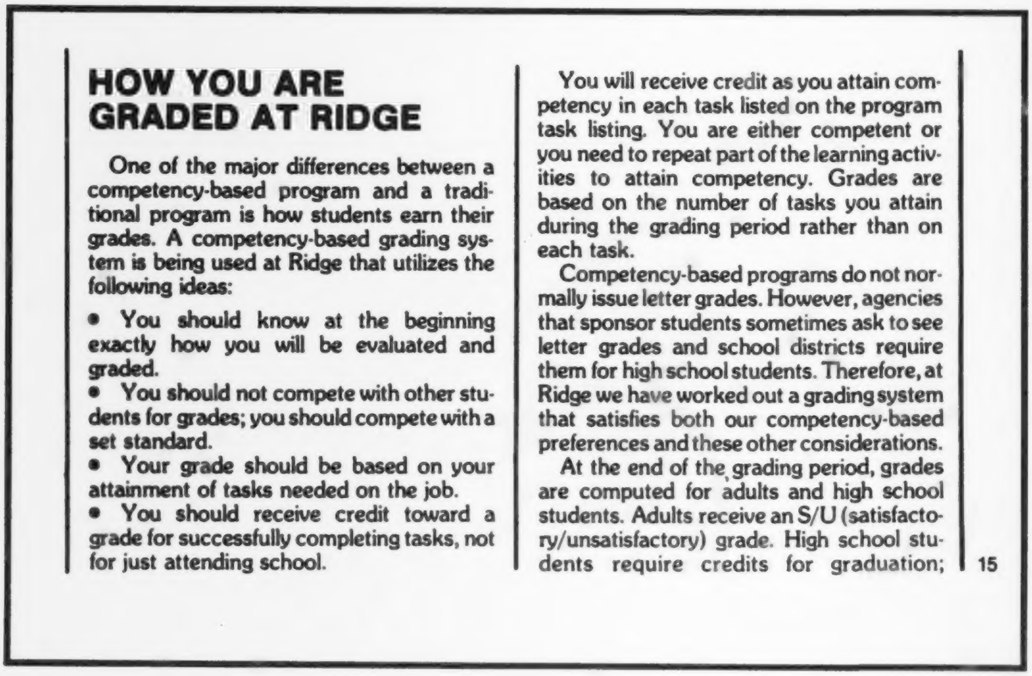
CBE Grading Systems

The Number of Tasks Mastered During a Given Grading Period (Ridge Vo-Tech) (432-435)

Pass/Fail (Pinellas Vocational Technical Institute) (436-437)

The Mastery of Achievement Level Reached for Each Task (State of Florida, TSTI-Amarillo) (438-441)

The following resource explains a grading system used at Ridge Vo-Tech in Winter Haven, Florida that is based on the number of tasks mastered during a given grading period. Students at Ridge Vo-Tech are also graded on their work habits and attitude. An explanation of this grading system follows.



HOW YOU ARE GRADED AT RIDGE

One of the major differences between a competency-based program and a traditional program is how students earn their grades. A competency-based grading system is being used at Ridge that utilizes the following ideas:

- You should know at the beginning exactly how you will be evaluated and graded.
- You should not compete with other students for grades; you should compete with a set standard.
- Your grade should be based on your attainment of tasks needed on the job.
- You should receive credit toward a grade for successfully completing tasks, not for just attending school.

You will receive credit as you attain competency in each task listed on the program task listing. You are either competent or you need to repeat part of the learning activities to attain competency. Grades are based on the number of tasks you attain during the grading period rather than on each task.

Competency-based programs do not normally issue letter grades. However, agencies that sponsor students sometimes ask to see letter grades and school districts require them for high school students. Therefore, at Ridge we have worked out a grading system that satisfies both our competency-based preferences and these other considerations.

At the end of the grading period, grades are computed for adults and high school students. Adults receive an S/U (satisfactory/unsatisfactory) grade. High school students require credits for graduation;

15

continued on the next page

therefore, the grading system is adjusted for the number of credits needed and a letter grade is given. The Guidance Office will discuss the grading procedure with each high school student.

HERE'S HOW IT WORKS...

Each task in your program is worth a set number of standard hours of credit toward a grade. For example, a particular task may be worth 12 standard hours of credit. When you successfully complete the task, you get 12 hours of credit toward your grade — *no matter how many or how few hours it actually took you to attain the task.* Remember this point! It's basic to understanding the grading system.

If you are a full-time day student, you receive instruction 5¼ hours a day, 5 days a week for a 6-week grading period, or 157 hours (5¼ × 5 × 6 = 157). In this case you will be held responsible for accomplishing 157 hours worth of learning.

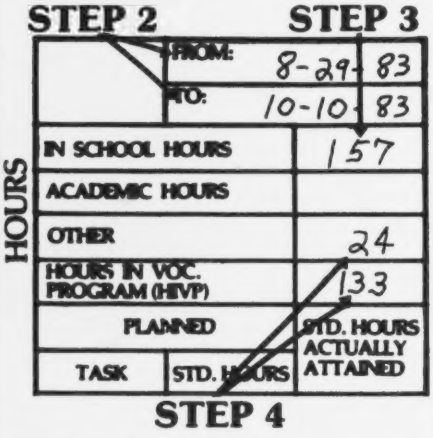
If you are a student in a vocational program and you are out for one or more academic classes or attend the Individualized Manpower Training System (IMTS) program, you will be receiving instruction for less than 157 hours, let's say 130. In such a case, you would be held responsible for accomplishing 130 hours' worth of learning.

A CASE HISTORY or... How Tom Clark, a Typical Ridge Student Got His Grades

Tom is a full-time adult student enrolled at Ridge in Automotive Mechanics. He is also attending IMTS to improve his math skills. Here are the steps Tom took in planning his program. You will see how he ultimately obtained his grades.

STEP 1 Tom and his instructor sat down at the beginning of the grading period to plan together the tasks that Tom would agree to attain during the grading period. The instructor gave Tom a *student performance agreement form* — the official form that students at Ridge are required to fill out each grading period for the purpose of planning their work and figuring their grades. (See the sample student performance agreement form for adult students on the next page.) This same form has been modified for high school students.

STEP 2 The dates covered by this grading period were entered in the FROM and TO spaces of the form.



FROM: 8-29-83
TO: 10-10-83

IN SCHOOL HOURS	157
ACADEMIC HOURS	
OTHER	24
HOURS IN VOC. PROGRAM (HIVP)	133

PLANNED		STD. HOURS ACTUALLY ATTAINED
TASK	STD. HOURS	

STEP 3 The total number of hours that Tom would be attending was entered in the IN SCHOOL HOURS space.

STEP 4 The number of hours Tom would be away from his vocational program was entered in the OTHER space. This number was subtracted from IN SCHOOL HOURS to obtain the number of HOURS IN VOC. PROGRAM (HIVP). Tom planned to be in IMTS 24 hours during this grading period, so 157 - 24 = 133. From this calculation — the HIVP — we learn that Tom would be held responsible for 133 hours worth of learning during the first grading period.

STEP 5 Since he would be responsible for 133 hours of learning, Tom and his instructor agreed on a list of tasks Tom would attain that had a total of at least 133 standard hours.

a. They selected the task numbers and standard hours directly from the program task listing and entered them on the student performance agreement form.

b. The standard hours for these tasks were totaled, and were seen to exceed the HIVP minimum required. Had they been less, more tasks would have needed to be added.

c. Tom initialed the form to show that he was aware of what was expected of him during this grading period.

STEP 5

PERFORMANCE AGREEMENT

	PLANNED		STD. HOURS ACTUALLY ATTAINED	
	TASK	STD. HOURS		
	A-01	10		
	A-02	5		
	A-03	20		
	B-01	20		
	B-02	16		
	B-04	10		
	B-05	5		a
	C-01	12		
	C-03	15		
	C-10	10		
	D-3	10		
	BRAKES	6		
b	TOTALS	139		
c	STUDENT INITIALS	T.C.		

STEP 6

PLANNED		STD. HOURS ACTUALLY ATTAINED
TASK	STD. HOURS	
A-01	10	9/2 MT
A-02	5	9/3 MT
A-03	20	9/15 MT
B-01	20	9/19 MT
B-02	16	9/21 MT
B-04	10	9/27 MT
B-05	5	10/3 MT
C-01	12	10/5 MT
C-03	15	⑤ MT
C-10	10	
D-03	10	
BRAKES	6	9/26 MT
TOTALS	139	
STUDENT INITIALS	T.C.	

Tom and his instructor could have added or removed tasks from this list at any time during the grading period if they wanted to. Notice that work assignments not on the program task listing (like brake job) can be planned. Just remember you must agree to as many standard hours of work as you plan to be spending in the vocational program (HIVP)!

STEP 6 As the weeks progressed and Tom successfully attained task A-01 by completing the knowledge test and performance test, his instructor initialed and dated the space on the performance agreement to the right of task A-01. Each time Tom successfully attained a task, his instructor initialed and dated the appropriate space.

If you feel that you can pass the performance test on any of the program tasks based on your previous experience, ask the instructor to give you a pretest. If you demonstrate competency, the standard hours attained will count toward high school credits, or early exit if you are an adult. If you do not demonstrate competency, you will be expected to go through the learning guides as usual.

STEP 7 At the end of the grading period, Tom and his instructor sat down to figure Tom's grade. They added up the total standard hours for those tasks attained. The instructor included 5 hours for C-03 during the grading period for a total of 109 hours.

Notice that Tom actually attained tasks A-01, 02, 03, B-01, 02, 04, 05, C-01, and did a brake job. Also notice that Tom completed a substantial part of task C-03 and got 5 hours credit toward his grade. Tom did not complete tasks C-10 and D-03.

STEP 7

PLANNED		STD. HOURS ACTUALLY ATTAINED
TASK	STD. HOURS	
A-01	10	9/2 MT
A-02	5	9/5 MT
A-03	20	9/15 MT
B-01	20	9/19 MT
B-02	16	9/21 MT
B-04	10	9/27 MT
B-05	5	10/3 MT
C-01	12	10/5 MT
C-03	15	⑤ MT
C-10	10	
D-03	10	
BRAKES	6	9/26 MT
TOTALS	139	109
STUDENT INITIALS	T.C.	
%	GRADE	

These hours were the standard hours assigned to each task taken from the program task listing, and not the time spent in attaining them that Tom recorded on his time card.

STEP 8 Tom and his instructor converted the standard hours that Tom actually attained into a percentage. The percentage reflects the proportion of hours attained (109) to the hours in the vocational program (133). To obtain the percentage, they divided the ACTUAL TASKS ATTAINED by the HIVP:

```
        .819 or 82%
133 |109.000
     105 6
       3 40
       2 64
        760
```

To see whether he obtained a satisfactory grade, they simply consulted the Polk County grading scale. A satisfactory grade is 73% or above.

Polk County Grading Scale

A	(93-100%)	Superior	S
B	(85-92%)	Above Average	
C	(73-84%)	Average	
D	(65-72%)	Below Average	U
F	(0-64%)	Failure	

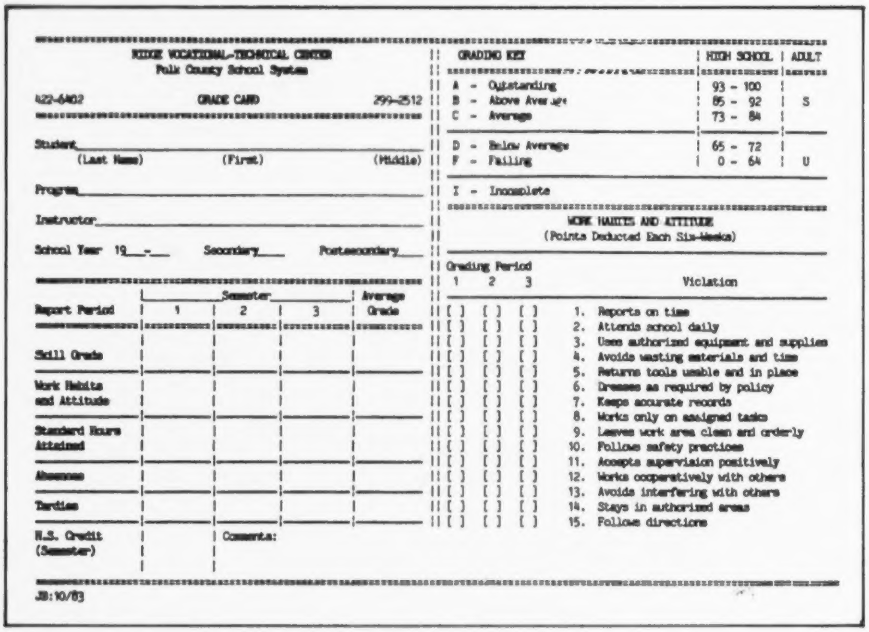
Tom saw that his 82% was a satisfactory grade. Had Tom been a high school student, his grade would have been a C. Because he was an adult, he received an S.

The top grade attainable is 100%, but additional tasks beyond the 100% completed during the grading period will be applied toward early exit from the program. These extra hours cannot be used in the computation of the next grading period. Adults who complete all tasks in the program are able to exit early, ready to enter the job market. High school students who are still attached to their home high school until graduation may exit early from their vocational class through the Industrial Cooperative Education (ICE) program, provided they have completed all their academic requirements.

WORK HABITS AND ATTITUDES

You are graded at Ridge not only on your attainment of tasks but also on the work habits and attitudes listed below. The instructors and advisory committee members agree that these 15 items are an important aspect of a vocational student's preparation. The lack of these skills is often the reason why workers lose their jobs.

1. Reports on time.
2. Attends school daily.
3. Uses authorized equipment and supplies.
4. Avoids wasting materials and time.
5. Returns tools usable and in place.
6. Dresses as required by policy.
7. Keeps accurate records.
8. Works only on assigned tasks.
9. Leaves the work area clean and orderly.



RIDGE VOCATIONAL-TECHNICAL CENTER
Polk County School System

422-6402 GRADE CARD 299-2512

Student________________________________
(Last Name) (First) (Middle)

Program________________________________

Instructor________________________________

School Year 19___-___ Secondary____ Postsecondary____

Report Period	Semester 1	Semester 2	Semester 3	Average Grade
Skill Grade				
Work Habits and Attitude				
Standard Hours Attained				
Absences				
Tardies				
H.S. Credit (Semester)		Comments:		

JB:10/83

GRADING KEY	HIGH SCHOOL	ADULT
A - Outstanding	93 - 100	
B - Above Average	85 - 92	S
C - Average	73 - 84	
D - Below Average	65 - 72	
F - Failing	0 - 64	U
I - Incomplete		

WORK HABITS AND ATTITUDE
(Points Deducted Each Six-Weeks)

Grading Period 1	2	3	Violation
[ ]	[ ]	[ ]	1. Reports on time
[ ]	[ ]	[ ]	2. Attends school daily
[ ]	[ ]	[ ]	3. Uses authorized equipment and supplies
[ ]	[ ]	[ ]	4. Avoids wasting materials and time
[ ]	[ ]	[ ]	5. Returns tools usable and in place
[ ]	[ ]	[ ]	6. Dresses as required by policy
[ ]	[ ]	[ ]	7. Keeps accurate records
[ ]	[ ]	[ ]	8. Works only on assigned tasks
[ ]	[ ]	[ ]	9. Leaves work area clean and orderly
[ ]	[ ]	[ ]	10. Follows safety practices
[ ]	[ ]	[ ]	11. Accepts supervision positively
[ ]	[ ]	[ ]	12. Works cooperatively with others
[ ]	[ ]	[ ]	13. Avoids interfering with others
[ ]	[ ]	[ ]	14. Stays in authorized areas
[ ]	[ ]	[ ]	15. Follows directions

10. Follows safety practices.
11. Accepts supervision in a positive manner.
12. Works cooperatively with others.
13. Avoids interfering with others.
14. Stays in authorized areas.
15. Follows directions.

Each grading period students will start with 100 points and will be marked down as they commit violations of the items on the list. Instructors will keep a reporting sheet on each student's work habits and attitudes. The grade will be the number of remaining points after all the points have been deducted for undesirable behavior. Ridge has individualized learning materials on work habits and attitudes available to the student.

D-10

Many schools have adopted a pass/fail (mastery/nonmastery) grading system. Students have either mastered or not mastered a task. Most schools that use a pass/fail type system do not use courses but simply list tasks on a transcript. The example of a pass/fail grading system on the next page is the first page of a student transcript from a Heavy Duty Truck and Bus Mechanics Program at Pinellas Vocational Technical Institute.

STUDENT TRANSCRIPT

SCHOOL BOARD OF PINELLAS COUNTY

VOCATIONAL, TECHNICAL, AND ADULT EDUCATION DIVISION

Pinellas Vocational Technical Institute
6100 - 154th Avenue North
Clearwater, FL 33520

Name: Last First Middle

Address

Date of Birth

Social Security No.

Dates of Attendance:

1.
2.
3.
4.
5.
6.
7.
8.

9123 HEAVY DUTY TRUCK & BUS MECHANICS
Task Listing

A - ORIENTATION, SAFETY, & BASIC KNOWLEDGE

TASK		GR
01	Using your PVTI Learning Guide	
03	Identify shop maintenance procedures	
04	Identify shop safety procedures	
05	Identify hand tools & their uses A	
06	Identify hand tools & their uses B	
07	Using micrometers	
08	Using dial indicators, feeler gauges	
09	Using rulers & calipers	
10	Identify power tools & their uses	
11	Identify fasterners & their uses	
12	Identify fittings & their uses	
13	Sharpen hand tools & drill bits	
14	Identify taps & dies & their uses	

B - CHASSIS MAINTENANCE

TASK		GR
01	Perform preventive maintenance inspection A	
02	Perform preventive maintenance inspection B	

C - MAINTAINING & PREPARING HYDRAULIC BRAKES

TASK		GR
01	Demonstrate knowledge of hydraulic brake principles	
02		

C - MAINTAINING & PREPARING HYDRAULIC BRAKES CONTINUED

TASK		GR
03	Refinish brake drums & rotors	
04	Service front disc brake system	
05	Rear drum brake & hydraulic system service	
06	Remove, inspect, & replace master cylinder	
07	Test & replace defective power unit	
08	Perform related task (live work)	

D - MAINTAINING & REPAIRING AIR BRAKES

TASK		GR
01	Refinish heavy duty drums	
02	Servicing of S - cam brakes	
03	Servicing of wedge brakes	
04	Perform related tasks (live work)	

E - MAINTAINING & REPAIRING AIR SYSTEM

TASK		GR
01	Identify air valves & describe operation of tractor trailer system	
02	Describe operation, diagnose, & perform minor repair to air compressor	
03	Perform air system check-out, troubleshoot, & repair air system	

GRADING SYSTEM

T = Transfer Credit
Q = Equivalency Credit
M = Mastered
NM = Not Mastered
NA = Not Attempted

The State of Florida, Department of Education has developed a series of career maps. These career maps contain a rating system based on different mastery levels and a listing of tasks for a specific occupation. Page 440 contains a sample of the rating system and several tasks from a laser electro-optics technology program. The letter "P" or "C" can be found above each task statement. "P" indicates a performance skill; "C" indicates a cognitive skill.

A sample of a grading policy used in the Commercial Art in Advertising Program at Texas State Technical Institute illustrates how a traditional A, B, C, F grading system (variable ratings of mastery) can be adapted to mastery learning. The example includes an explanation of the grading system and performance test standards. A grade of "C" implies that a student has mastered job entry skills, while grades of "A" and "B" indicate a higher mastery level.

1	PERFORMS THIS COMPETENCY SATISFACTORILY WITH SUPERVISION
2	PERFORMS THIS COMPETENCY SATISFACTORILY WITH ONLY PERIODIC SUPERVISION
3	PERFORMS THIS COMPETENCY SATISFACTORILY WITHOUT SUPERVISION

RATINGS ON THE MERIT ACHIEVEMENT PLAN (CAREER MAP) ARE INDUSTRIAL PERFORMANCE STANDARDS. THEY ARE CONFIRMED BY AN INSTRUCTOR (A SKILLED AND EXPERIENCED PERSON FROM THIS OCCUPATION) WHO VIEWS AND EVALUATES PERFORMANCE AS HE OR SHE WOULD IN THE ROLE OF AN EMPLOYER OR SUPERVISOR.

H-004. (C) DESCRIBE BASIC OPTICAL CAVITIES & LASING ACTION 1☐ 2☐ 3☐ AUTHENTICATION	**H-005.** (C) DIAGRAM & EXPLAIN THE ELEMENTS OF A BASIC LASING SYSTEM 1☐ 2☐ 3☐ AUTHENTICATION	**H-006.** (P) OPERATE A BASIC LASER SYSTEM INSURING PERSONNEL SAFETY 1☐ 2☐ 3☐ AUTHENTICATION	**H-007.** (P) OPERATE A BASIC LASER SYSTEM INSURING HARDWARE & PROPERTY SAFETY 1☐ 2☐ 3☐ AUTHENTICATION	**H-008.** (P) MEASURE THE WAVELENGTH OF BASIC LASERS 1☐ 2☐ 3☐ AUTHENTICATION
I-004. (P) DIAGRAM & MEASURE REFLECTION CHARACTERISTICS OF SPHERICAL SURFACES 1☐ 2☐ 3☐ AUTHENTICATION	**I-005.** (P) DIAGRAM & MEASURE REFRACTION CHARACTERISTICS OF PLANE SURFACES 1☐ 2☐ 3☐ AUTHENTICATION	**I-006.** (P) DIAGRAM & MEASURE REFRACTION CHARACTERISTICS OF SPHERICAL SURFACES 1☐ 2☐ 3☐ AUTHENTICATION	**I-007.** (P) MEASURE TRANSMISSION & ABSORPTION OF OPTICAL MATERIALS (PROPAGATION) 1☐ 2☐ 3☐ AUTHENTICATION	**I-008.** (P) DEMONSTRATE DIFFRACTION & INTERFERENCE 1☐ 2☐ 3☐ AUTHENTICATION
J-004. (P) MEASURE & CORRECT LENS SYSTEM FOR MINIMUM ABBERATIONS 1☐ 2☐ 3☐ AUTHENTICATION	**J-005.** (P) DEMONSTRATE THE EFFECT OF F STOPS & APERTURES 1☐ 2☐ 3☐ AUTHENTICATION	**J-006.** (P) DEMONSTRATE OR MEASURE THE PROPERTIES OF GRATINGS 1☐ 2☐ 3☐ AUTHENTICATION	**J-007.** (P) DEMONSTRATE THE FUNDAMENTAL CHARACTERISTICS OF IMAGE ERECTION SYSTEMS 1☐ 2☐ 3☐ AUTHENTICATION	**J-008.** (P) DEMONSTRATE THE MATRIX METHOD OF RAY TRACING THROUGH OPTICAL SYSTEMS 1☐ 2☐ 3☐ AUTHENTICATION
K-004. (P) ANALYZE PULSED LASER POWER SUPPLIES 1☐ 2☐ 3☐ AUTHENTICATION	**K-005.** (P) CONSTRUCT PULSED LASER POWER SUPPLIES 1☐ 2☐ 3☐ AUTHENTICATION	**K-006.** (P) TROUBLESHOOT PULSED LASER POWER SUPPLIES 1☐ 2☐ 3☐ AUTHENTICATION	**K-007.** (P) ANALYZE FLASHLAMP IGNITION & SIMMER CIRCUITS 1☐ 2☐ 3☐ AUTHENTICATION	**K-008.** (P) CONSTRUCT FLASHLAMP IGNITION & SIMMER CIRCUITS 1☐ 2☐ 3☐ AUTHENTICATION
L-004. (P) ANALYZE LASER POWER & ENERGY DETECTORS 1☐ 2☐ 3☐ AUTHENTICATION	**L-005.** (P) TROUBLESHOOT LASER POWER & ENERGY DETECTORS 1☐ 2☐ 3☐ AUTHENTICATION	**L-006.** (P) CALIBRATE LASER POWER & ENERGY DETECTORS 1☐ 2☐ 3☐ AUTHENTICATION	**L-007.** (P) DEFLECT A LASER BEAM WITH A GALVANOMETER (MECHANICAL) 1☐ 2☐ 3☐ AUTHENTICATION	**L-008.** (P) DEMONSTRATE Q SWITCHING METHODS (DYE, EO, AO, & MECHANICAL) 1☐ 2☐ 3☐ AUTHENTICATION
M-004. (C)				

Grading Policy

Karen R. Atkins
Instructor-Commercial Art in Advertising

In the courses taught by Karen Atkins, the grading policy is as follows:

90-100=A
80-89=B
70-79=C
Below 70 is unacceptable=F

70-79% represents Average ability for job entry.
80-89% represents Above average ability for job entry.
90% or better represents Excellent ability for job entry.

Performance Test:

Since commercial art is a subjective field in practice, it is necessary to evaluate areas of subjectivity such as creativity, design, artistic interpretation, color, professionalism, etc. It is also necessary to reward those who exceed the minimum requirements for job entry. This is accomplished through a point system. 70%, or C, means that a student simply followed the directions given and has sufficient skills to function on the job at entry level. To receive a higher score, the student must display creativity, professionalism, neatness, etc. At the need of each performance test is a listing of the performance standards to be rated against, including the point system to be used. A student receiving less than 70% must retake the performance test until minimum standards are met (70%).

Knowledge Test:

Students must complete knowledge tests with 90% accuracy before being allowed to continue to the next task.

Each individual course contains a set tasks including the clock hours required (average) to complete them. The scores of each task are averaged together to achieve the final grade. EXAMPLE: CAA 523-Corporate Design, contains three tasks, each to occupy 20 clock hours. The three scores are averaged together to achieve the final grade. In courses where tasks require varied clock hours, the process follows this example: CAA 563-Screenprinting, contains four tasks, A01=10 hours, A02=10, A03=15, A04=25. A01 counts twice, A02 counts twice, A03 counts three times, A04 counts five times. The total is divided by 12, hence the final score. If you have any questions concerning grades please contact your instructor.

PERFORMANCE TEST FOR Duty V Task 01
CONTINUED

PERFORMANCE TEST STANDARDS
ALL ITEMS MUST BE ANSWERED YES FOR ATTAINMENT YES NO

---

1. Asked instructor questions concerning client.
2. Design no smaller than 4"x4".
3. 25 thumbnails produced by prescribed deadline.
4. Instructor shown thumbnails.
5. Three roughs indicated by prescribed deadline.
6. Instructor shown roughs.
7. Final comp produced with PERFECTION--
   NO WHITE OUT by prescribed deadline.
8. Final is properly flapped and labelled.
9. Proper media and board used.

When above answered 100% YES, product is 70% (C) complete!
Below is point system for attainment of higher rating.

10. Logo design is compatible with company's purpose. (5 points)
11. Logo will reduce and enlarge without losing identity. (10 points)
12. Logo is distinctive, unique. (5 points)
13. Logo is contemporary. (5 points)
14. Logo choice of color is appropriate and individual. (5 points)

TOTAL ___________

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prepared by Karen Atkins PAGE 19 OF 19

TSTI-Amarillo Attendance/Progress Policy and Procedure

The following resource is an attendance/progress policy developed at Texas State Technical Institute-Amarillo. The policy is located on pages 445-452. This policy refers to several forms which are not included in the Resource Guide. A one page description (student handout) is also included. This policy and procedure is not given to students; they receive the handout (p. 444).

Student Information-Attendance and Progress

Poor attendance is a leading reason for termination from a job in all areas of employment. With this fact in mind your instructor monitors and records your progress and attendance daily.

You, along with your faculty advisor will complete a Student Schedule Attendance Contract at the beginning of your enrollment period and this document will be used as the basis for evaluating your attendance.

Absences due to illnesses or emergencies are the only justifiable reasons for absences from TSTI.

You are in violation of the attendance policy if you are absent from more than 10% of your scheduled course hours per month (three tardies equal 4 hours absence). If you are absent more than 10% (clock hours) you will then be placed on attendance probation. If you are absent for more than 15% of scheduled course hours per month, you may be terminated from a course or program. For example, if you are scheduled to attend 30 hours in a particular course during a one month period, and if you miss more than 3 hours of the course you will be placed on attendance probation and if you miss more than 4.5 hours, you may be terminated from the course by your instructor.

You are also expected to demonstrate satisfactory progress. Your progress is measured based on a "standard time" for each task in the training program. A regular full time student is required to master a mininmum of 6 hours per day or 30 hours per week of task hours. This allows you to progress at a rate of 100% and to complete the training program on time. Any progress rate of less than 100% means that you may not complete the program on time. When your rate of progress falls below 90% you may be placed on probation.

The standards of attendance and progress described above are the minimum acceptable for continued enrollment at TSTI and may be stricter based on the requirements of the program in which you are enrolled.

If you have any questions regarding the accuracy of attendance/progress data you should contact your instructor or major program chairman.

Specific details of this policy are contained in TSTI-Amarillo Manual of Policy, Number 3.44 dated August 13, 1986.

TSTI AMARILLO

MANUAL OF PROCEDURES

TITLE	Attendance and Progress Policy	NUMBER 3.44	PAGE 1 of 8
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PROCEDURES:

1. The instructor has the primary responsibility for making students aware of this policy and for seeing that students maintain an appropriate attendance and general progress record while enrolled at TSTI. The instructor will inform all new students about the importance of maintaining a good record of attendance and progress while at TSTI. Absences due to illnesses or emergencies are the only justifiable reasons for any absence from TSTI. This policy outlines the responsibility for determining when there is an attendance and/or progress problem.

2. The student should seek prior approval from the instructor for any occasions requiring his/her absence from TSTI for special types of reasons such as scheduled appointments and religious observances.

3. It is the responsibility of the major program chairman or his designee to provide each student with a written copy of the attendance/progress policy during program orientation. Attendance data, as collected by the instructor and submitted to the admission's office will be maintained by the instructor for the student's review. If a student questions the accuracy of the attendance/progress data, the student may pursue the matter with the instructor or major program chairman.

    a. Attendance data concerning the number of hours absent while at TSTI will be maintained by the major program chairman for reference upon inquiry by prospective employers but will be released only upon the written consent of the student.

    b. A student is not to be excused from TSTI except for illness and/or other emergencies. Warnings will be initiated on students whose absences exceed a rate of 10% of the scheduled course hours per calendar month as indicated on the student contract (Three tardies are equivalent to 4 hours absence.) as defined in the policy in an effort to correct the problem. If the problem is not corrected, termination may result. No student will be terminated without following due process.

    c. An absence, excused or unexcused, is considered an absence for reporting purposes. Students who have an illness should notify their instructor that they will be absent prior to their session start-time, and they may be assigned an excused absence. An excused absence can be made up after coordination with the instructor.

Donald De	
TITLE Campus President	DATE September 10,1986

TSTI AMARILLO

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4. A leave of absence, not to exceed two weeks, may be granted to a student with a personal or family emergency or to students whose health or general welfare is likely to be severely impaired if not given a leave of absence. An appropriate Leave of Absence form should be signed (a copy of the form is attached to this policy). Each request requires prior approval of the major program chairman, and a counselor. Students are charged regular tuition during a leave of absence.

SECTION I - ATTENDANCE

1. On the first day of the enrollment period the student reports to his or her major program chairman, the student will then meet with a faculty advisor to reach an agreement on what attendance schedule the student will adhere to in order for the student to successfully complete all courses/tasks taken during the current enrollment period. This schedule will then become the Student Attendance Contract. (See attached sample)

    a. Copies of the Student Attendance Contract will be provided to all appropriate instructors, the student, and one will be placed on file in the student's record in the major program area.

    b. This contract will also include any related study courses or any other courses the student will be taking outside the major program.

    c. The student attendance contract will not be changed without the permission of the student's faculty advisor and major program chairman.

    d. This contract/schedule will serve as the basis for all future attendance/progress reports.

2. The instructor is required to record each student's absence or attendance at the beginning and at the end of each session, and report it according to TSTI's procedures.

    a. A session may be considered as one or more scheduled periods depending on the order a student's courses are scheduled. As an example, for a student who has the same course scheduled the first and second periods, the instructor will take role at the beginning

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of the first period and the end of the second period. If the student is not present at the end of the second period, the instructor will report the student as being four hours absent.

b. A student who does not report to a scheduled period on time, but arrives within 15 minutes of the scheduled period start time will be considered tardy.

c. For those students who are abusing the attendance policy of TSTI with more than 10% of scheduled course hours absence per month, but less than 15%, the following process will be implemented:

(1) The instructor will begin counseling with the student, following the next absence, documenting this by giving the student the Attendance Warning Letter Part I (attached) and forwarding copies to the appropriate staff listed. (NOTE: Be sure to ask each student to sign that they have received the letter and, if they refuse to sign, make a note of the time, date and place of the conference. If the student is not available for a signature, a certified letter should be sent through the mail, and the instructor is to maintain documentation of the letter being sent.)

(2) If the student's absence continues to exceed 10% of the scheduled hours during the following month, the instructor will initiate the multiple copy Excessive Absence Report and send it to the major program chairman, along with all relevant attendance information.

(3) The major program chairman will review and forward the attendance documentation along with the Excessive Absence Report to the counseling office.

(4) Within five days of receipt of all documentation and reports the counselor shall counsel the referred student about this absenteeism, and inform the major program chairman and instructor of any action to be taken as a result of the counseling session.

(5) The counseling office shall maintain a record of all counseling sessions by means of the Excessive Absence Report.

Ronald DeSpain	
TITLE Campus President	DATE September 10,1986

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d. For those students who, during any one month of attendance, have absences of 15% or more of scheduled hours or courses, the following process will occur:

(1) The instructor will inform the major program that Attendance Warning Letter Part I and II should be forwarded to the student.

(2) If the student does come in after receiving the Attendance Warning Letter, the program chairman will reestablish the new Student Attendance Contract with the student. A copy of this contract will be forwarded to the instructor, faculty advisor, counselor, and placed in the student's file.

(3) If the student does not adhere to the contract agreement, the instructor will complete the instructor recommendations area on the Excessive Absence Report and send the report and copies of all appropriate documentation to the major program chairman for review.

(4) The major program chairman sends the Excessive Absence Report and all appropriate documentation to the dean of instruction for action at the earliest possible date. The recommendation for a student to be dropped from a course or terminated from a program must receive the concurrence of the dean of instruction or his designee.

(5) The dean of instruction or his designee shall sign within three days after receiving the Excessive Absence Report and forward copies to the student, major program chairman, counseling office, the admission and records office and the financial aid office.

SECTION II - PROGRESS

1. The progress of each student is recorded after completion of each task. Institute approved task listings for a program are issued to each student upon enrollment in a program.

2. Each instructor is required to maintain a record of student progress in a course or assigned task.

Donald De Spain

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3. The TSTI competency-based instructional system is designed to prepare students to successfully enter the job market with the required skills, knowledge and attitudes needed to gain entry level employment in the student's chosen field. The role of the instructor together with TSTI's competency-based instructional system is to aid students in acquiring the appropriate level of skills.

4. TSTI has defined a "standard time" for each task in the approved training program. The "standard time" means that a typical (average) student is able to complete the task in the number hours listed on the task list. Based on the standard time, each full-time (regular) student is required to master at least a minimum of 6 hours per day or 30 hours per week of task hours. This will enable the student to progress at a rate of 100% and to complete the training program on time. Any progress rate of less than 100% means that a student may not complete the program on time. Students are judged to be making less than the required progress if the total accumulation of hours and tasks mastered is less than the total number of hours enrolled in the program.

   Students may or may not become eligible to be placed on probation at the discretion of the major program faculty if their monthly rate of progress falls below 90% of the total number of hours which the student was enrolled in for a given month, and/or overall progress for the length of time enrolled.

5. Less than satisfactory performance may be acceptable if:

   a. Long-term personal illness occurred (2 weeks or more), but the student wishes to continue in the program and, in the judgement of the instructor, the student is likely to progress satisfactorily.

   b. In the judgment of the instructor, the student is making maximum effort to perform in this program, yet has difficulty with the program, but is likely to complete a certificate of the program within a reasonable period of time and find placement in this field. A plan for the individual student will be developed in coordination with the major program chairman, faculty advisor, and counselor listing the specific objectives that need to be accomplished to resolve this problem (additional language and reading skills, training, etc.).

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c. A system discrepancy, due to the various ways data is collected and reported may cause the student's progress to show up as being less than 90% but, in actuality, the mastery has been within the 90% requirement.

Students whose progress rate is less than 90% for reasons other than those listed above will be placed on probation on a monthly basis. Reasons for being placed on probation may also include absences, tardiness, not applying time to learning while in attendance (excessive lounge or break time), and refusing to complete certain required segments of instruction.

6. The instructor will:

   a. Review the progress record of each student on a monthly basis.

   b. Distribute progress reports to individual students who are not making satisfactory progress.

   c. Make recommendations as to the status, checking item A, B, C or D (see attached Student Progress Report) of each student having an overall rate of progress less than 90% competencies mastered.

7. The first time a student's progress is below an overall rate of 90% the instructor will meet with the student within 5 days of the instructor's review of the progress report, to inform the student that his/her progress is below the 90% requirement. The instructor will sign item A and the student will sign Item E.

   a. Each subsequent time the progress is below 90%, a referral is sent by the instructor to the major program chairman on the Student Progress Form and a meeting will be scheduled.

   b. Documentation must be completed and on file for all students whose overall progress rate is below 90%. An explanation is required if the student was not referred to the major program chairman (such as long-term illness, breakdown of equipment, etc.).

8. The major program chairman will arrange a conference time for those students referred. The instructor may be present if requested by the major program chairman or if, in the judgment of the instructor, the

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documentation provided needs further explanation or clarification. The student's progress will be reviewed, as well as any circumstances which might be a hindrance to the student's progress, and a plan developed to assist the student to bring progress up.

9. If the student does not succeed in bringing the overall progress up to 90% within one month, a conference should be scheduled by the instructor with the major program chairman. Item B will be checked, signed and dated by the major program chairman. Item E will be checked, signed and dated by the student. Copies will be distributed as specified.

10. The student will be referred back to the instructor to develop a contract, within 2 working days of the conference with the major program chairman, appropriate to assisting the student to improve progress. This contract will detail specifically, the number of hours and tasks that must be mastered for a period of 1 month on a daily basis.

    If appropriate, a referral to the counseling office may be made for career counseling or other supplemental services.

11. The major program chairman will follow up with the instructor and student of the program within one week of the conference to determine and document the status of the contract by making a note on the previous document.

12. If the student does not succeed in bringing overall progress up to 90% as stated in the contract, Item C will be checked, signed and dated by the major program chairman. Item E will be checked, signed and dated by the student. The major program sends the student Progress Report and all appropriate documentation to the dean of instruction for action at the earliest possible date. The recommendation for a student to be dropped from a course or terminated from a program must receive the concurrence of the dean of instruction or his designee.

13. The dean of instruction or his designee shall sign within three working days the Student Progress Report and forward copies to the student, major program chairman, counseling office, the admissions and records office, and the financial aid office.

Donald W. Snow

TITLE Campus President

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14. If the student successfully brings overall progress to 90% or above within the time specified, Item D will be checked, signed and dated by the instructor.

SECTION III - TERMINATION APPEALS

1. a. Persons wishing to appeal termination decisions shall, within seven (7) calendar days after the date of notification memo, request a hearing before the Attendance/Progress Committee.

   b. The Attendance/Progress Committee shall consist of the Director of Admissions, the Assistant Director of Financial Aids (who shall serve as the Committee Secretary), and six faculty members to be appointed by the Dean of Instruction for a term of two (2) quarters.

   c. The Attendance/Progress Committee shall elect a chairman from the appointed faculty members.

2. The student must contact either the Attendance/Progress Committee Chairman or Secretary to request an appeal hearing.

3. The Attendance/Progress Committee Chairman shall call all meetings of the Attendance/Progress Committee.

4. No student who has been recommended for termination may voluntarily withdraw from or drop a course or program and receive a grade of W (Withdrawn) until after the recommendation for termination has been acted upon.

5. Students terminated under this policy are issued a grade of F.

6. Decisions of the Attendance/Progress Committee shall be final.

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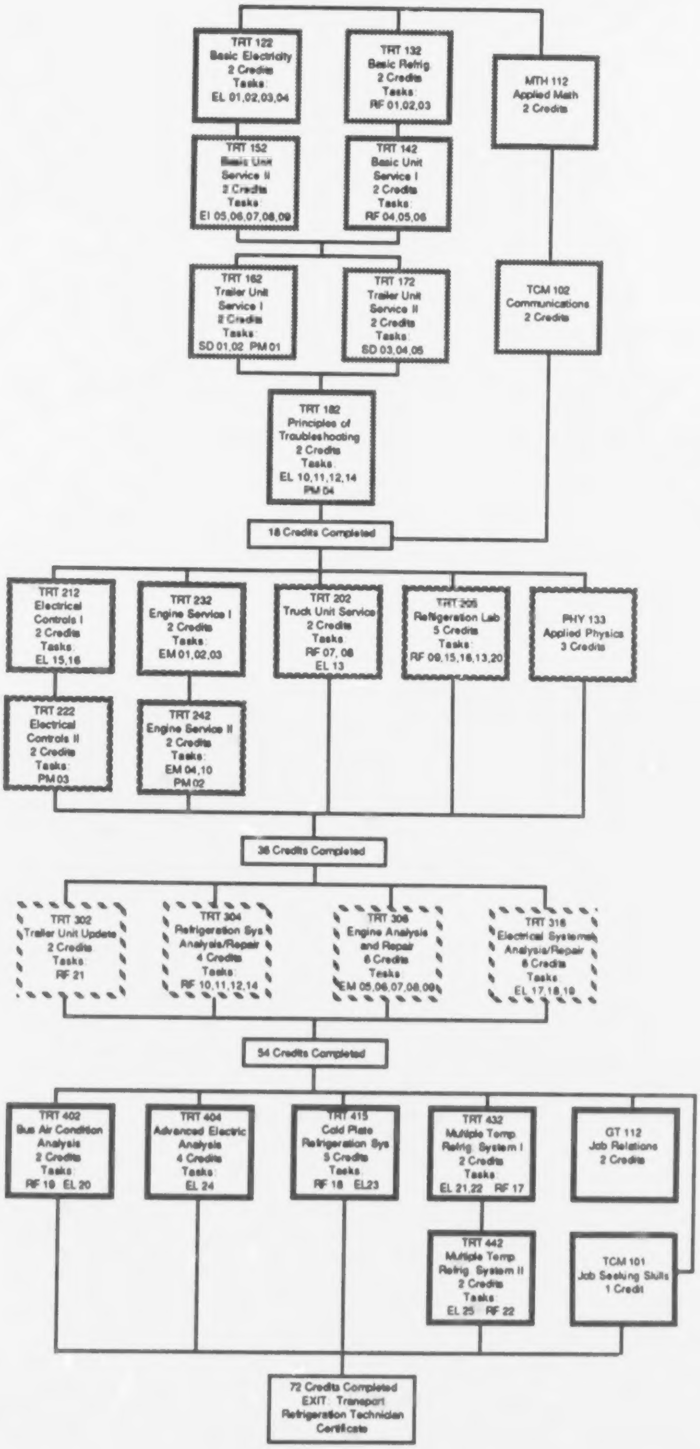
Course Mapping-Transport Refrigeration Mechanics

The following resource illustrates a course map. Each square on the "map" is a course. Tasks from the transport refrigeration technology program's task listing are also listed for each course. There are also several exit points in this program allowing students to work in suboccupations (Transport Refrigeration Mechanics Helper, Transport Refrigeration Mechanic Level I, Transport Refrigeration Mechanic Level II).

TRANSPORT REFRIGERATION TECHNOLOGY


TRT 122 Basic Electricity 2 Credits Tasks: EL 01,02,03,04
TRT 132 Basic Refrig 2 Credits Tasks: RF 01,02,03
MTH 112 Applied Math 2 Credits
TRT 152 Basic Unit Service II 2 Credits Tasks: El 05,06,07,08,09
TRT 142 Basic Unit Service I 2 Credits Tasks: RF 04,05,06
TRT 162 Trailer Unit Service I 2 Credits Tasks: SD 01,02 PM 01
TRT 172 Trailer Unit Service II 2 Credits Tasks: SD 03,04,05
TCM 102 Communications 2 Credits
TRT 182 Principles of Troubleshooting 2 Credits Tasks: EL 10,11,12,14 PM 04
18 Credits Completed
TRT 212 Electrical Controls I 2 Credits Tasks: EL 15,16
TRT 232 Engine Service I 2 Credits Tasks: EM 01,02,03
TRT 202 Truck Unit Service 2 Credits Tasks: RF 07, 08 EL 13
TRT 205 Refrigeration Lab 5 Credits Tasks: RF 09,15,16,13,20
PHY 133 Applied Physics 3 Credits
TRT 222 Electrical Controls II 2 Credits Tasks: PM 03
TRT 242 Engine Service II 2 Credits Tasks: EM 04,10 PM 02
36 Credits Completed
TRT 302 Trailer Unit Update 2 Credits Tasks: RF 21
TRT 304 Refrigeration Sys Analysis/Repair 4 Credits Tasks: RF 10,11,12,14
TRT 306 Engine Analysis and Repair 6 Credits Tasks: EM 05,06,07,08,09
TRT 316 Electrical Systems Analysis/Repair 6 Credits Tasks: EL 17,18,19
54 Credits Completed
TRT 402 Bus Air Condition Analysis 2 Credits Tasks: RF 19 EL 20
TRT 404 Advanced Electric Analysis 4 Credits Tasks: EL 24
TRT 415 Cold Plate Refrigeration Sys 5 Credits Tasks: RF 18 EL23
TRT 432 Multiple Temp Refrig System I 2 Credits Tasks: EL 21,22 RF 17
GT 112 Job Relations 2 Credits
TRT 442 Multiple Temp Refrig System II 2 Credits Tasks: EL 25 RF 22
TCM 101 Job Seeking Skills 1 Credit
72 Credits Completed EXIT: Transport Refrigeration Technician Certificate

Name____________________

Date entered____________________

Learning Guide Quality Control

A policy and procedure developed at Texas State Technical Institute-Amarillo and a learning guide evaluation checklist from Ridge Vo-Tech (Winter Haven, Florida) are included as samples of documents related to quality control of student learning guides.

RVTC LEARNING GUIDE EVALUATION CHECKLIST

Duty/Task No. ______________________ Task ______________________

Program ______________________ Instructor ______________________

DATE ACTION

1. ________ draft completed by instructor
2. ________ submitted to teacher educator
3. ________ submitted to curr. specialist
4. ________ typed
5. ________ reviewed by instructor
6. ________ 3 copies made and filed

Learning Guide should receive a "yes" response for each item.

	YES	NO
COVER PAGE		
1. Is the program name entered?		
2. Does task begin with an action verb?		
3. Is task stated exactly as found on the task listing?		
4. Is duty stated exactly as found on the task listing?		
5. Is purpose concise and to the point?		
6. Does purpose provide motivation to the student?		
7. Is all identifying information listed on the bottom of each page?		
8. Does "Given" include only those resources to be used while taking the Performance Test?		
9. Does "You Will" restate the task from the cover page?		
10. Does "How Well" call for the Written Test corrected at 100% and the Performance Test at 100% attainment?		
ENABLING OBJECTIVES		
11. Are Enabling Objectives listed in numerical order and does each begin with an action verb?		
12. Do EO's lead the student to attainment of the task?		
13. Can each EO stand alone as a meaningful unit of learning?		
EACH ENABLING OBJECTIVE PAGE		
14. Is there an EO page for each EO listed on the objectives page?		
15. Is the actual Enabling Objective listed in the box exactly as found on the objectives page?		
LEARNING STEPS		
16. Does the first learning step(s) present some knowledge or skill to the student?		
17. Is more than one learning step used to present the knowledge or skill if needed?		
18. Is one or more learning step(s) included that directs the student to apply or practice the knowledge or skill?		

YES NO

19. Is student feedback provided in a learning step such as a Self-Check, instructor check-point, etc.?
20. Does the last learning step direct the student to the next Enabling Objective?

RESOURCES

21. Are resources numbered to correspond with the appropriate learning steps?
22. Are multiple resources for a single learning step listed as a, b, c, d, etc.?
23. Are actual resources identified by title, number, etc.?
24. Are Instruction Sheets referred to in the following manner: "Instruction Sheet enclose, Using the Drill Press"?

INSTRUCTION SHEET

25. Is title listed at the top exactly as it is referred to on the EO page?
26. Does Instruction Sheet immediately follow the EO page on which it is referred?
27. Are procedural steps listed in numerical order?
28. Is each Instruction Sheet easy to read, uses appropriate illustrations and/or highlights key points?

SELF-CHECK

29. Are specific questions listed?
30. Is an Answer Key available for student feedback?

WRITTEN TEST

31. Is the Written Test called for before the student engages in practice of the last EO if EO is complex and dangerous?
32. Are only True-False, Matching and Multiple Choice items included?
33. Is the task and task number listed at the top of the test?
34. Do the general directions include:
    a. the purpose of the test?
    b. the overall directions?
    c. the description of the testing situation?
    d. any time limit imposed?
35. Are specific instructions included for each type of test item?

PERFORMANCE TEST

36. Is the task and task number listed?
37. Do the directions to the student include:
    a. the specific performance required?
    b. the description of the testing situation?
    c. any safety precautions to observe?
    d. any time restrictions?
38. Does the criteria fully sample the steps taught in the guide and begin with a verb in the past tense?
39. Is all identifying information listed on the bottom of the page?
40. Overall, does the Learning Guide lead the student to attainment of the task?

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A. General Information

1. All programs must have an approved validated task listing on file in the Curriculum and Instructional Development Offices.

2. All learning guides must be based on the validated task listing.

3. All learning guides shall be published on the approved TSTI format.

4. A learning guide must be developed for every task listed on the official task listing.

B. Learning Guide Approval

1. Upon the assignment of the program chairman, each faculty member shall work with the Instructional Development Office in developing learning guides for his program.

2. Once a learning guide has been developed, the faculty member, using the appropriate TSTI form, shall obtain the approval of the program chairman who will be responsible for checking the learning guide for content and the following:

   a. The performance objective is appropriate for the competency and is correctly stated.

   b. The enabling objectives lead to the accomplishment of the performance objective and are correctly stated.

   c. The learning activities are appropriate for the target audience, are varied and interesting, are relevant and not repetitive, involve a variety of instructional materials, and include clear directions to the student.

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d. The practice activities are appropriate for the competency covered and are practical and realistic.

e. Adequate and appropriate activities and devices for immediate and continual feedback are provided.

f. The final performance test requires performance of the skill in a realistic setting, involving an activity that is appropriate for the competency covered and includes clear directions to the student.

g. The performance includes all essential criteria (product, process time, attitudes) for assessing achievement of the competency, states the criteria, is reasonable in length, includes an appropriate rating scale, and includes an appropriate level of performance.

h. Instruction/information sheets are present, include up-to-date and accurate information, and provide sufficient information to teach the skill.

3. The faculty member shall send one typewritten draft copy with the approved TSTI Learning Guide verification form, attachment A, to the Instructional Development Office.

4. The Instructional Development Office will be responsible for checking the learning guide for the following:

   a. A title page includes and provides all the necessary identifying information.

   b. The learning guide task statement correctly matches the approved task listing statement.

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c. The introduction effectively and briefly explains what the skill is and why it is important. Also, the introduction provides motivation.

d. The performance objective is stated correctly.

e. The learning guide uses a variety of instructional materials and methods.

f. If included, the knowledge test has the central question or problem stated in the stem of each item.

g. The performance includes all essential criteria (product, process, time, attitudes) for assessing achievement of the competency, states the criteria in observable performance terms, lists only essential criteria, is reasonable in length, and includes an appropriate rating scale.

h. The learning guide is well written in terms of spelling, sentence structure, clarity of language and/or word choice, punctuation, capitalization, vocabulary level, reading level, brevity, and organization.

5. After the review is complete, the Instructional Development Office will either return the learning guide to the author for correction or send the document to the word processing center.

6. Once the document clears the word processing center, the Instructional Development Office will review the document and either return the learning guide to the word processing center for correction or approve the document and place one copy in its master file and print field test copies.

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7. Once approved by the Instructional Development Office, the program will conduct a field test for the purpose of seeing if the learning guide is effective in helping students master the task at a high level. The following steps will be taken by the program when conducting a field test:

   a. A minimum of three students shall be selected to participate in the field test. The students selected should be typical of the students who will eventually be using the learning guide. All prerequisites should be completed by the students prior to the field test.

   b. Care should be taken not to say more or less than normal to the students involved in the field test. The students should think they are just using another learning guide.

   c. The instructors should involve themselves only as the learning guide dictates.

   d. After each student has completed the guide, the instructor should explain that it was new and ask for the student's honest opinion about the guide.

   e. The instructor should analyze the results of the field test and look very carefully at the results of the written and performance tests.

   f. The instructor should make any needed changes in the learning guide and in the resources used prior to submission to the Instructional Development Office.

   g. One copy of the corrected learning guide should be sent to the Instructional Development Office for final approval and printing.

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8. The Program Chairman shall review the corrected learning guide and evaluate the document on the following:

    a. Was the learning guide field tested with a minimum of three students?

    b. Was little said to the field test students about the learning guide being tested.

    c. Was the instructor involved only as dictated by the learning guide?

    d. Was constructive criticism encouraged from each field test student?

    e. Were needed changes in the learning guide made based on the results of the field test?

9. After the evaluation, the Instructional Development Office will either send the document back to the author for needed changes or give authorization to the program for final printing and use in the program.

C. Learning Guide Revision

When additional changes and/or updates are necessary, the program shall repeat steps listed in item B, Learning Guide Approval.

D. Central Library

A central library of all approved learning guides shall be established and maintained by the Instructional Development Office.

1. Once a learning guide has been authorized for use in the program, one copy will remain in the central library as a permanent record.

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2. The central library should include all approved revisions made to a learning guide.

E. Monitoring

No learning guide shall be used in the program unless it carries the approval of the Instructional Development Office for permanent use or for field testing.

1. The Dean of Instruction or his designee will be responsible for conducting internal audits to ensure all learning guides used in programs are approved and located in the central library of the Instructional Development Offices.

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LEARNING GUIDE VERIFICATION FORM

As Program Chairman, I verify that Learning Guide __________ written by________________________ is correct in content and ready for the word processing center. I request __________ copies for our field test.

____________________________ Program Chairman

_________________ Date

Received by IDS for review _________________ Date

The above designated learning guide has been reviewed in the areas of form and design and is:

( ) APPROVED

( ) DISAPPROVED

( ) Returned to program __________ Date

COMMENTS: ____

Reviewed by ______________________________ ______________________ Date

Received at word processing center: ____________________ Name ________________ Date

Master copy received by IDS: ____________________ Name ________________ Date

To Printing: __________ Date

Master copy to file: ____________________ Name __________ Date

Field Test copies sent to program: __________ Date

Field Test review by IDS:

( ) Approved for use in the program:

( ) Returned to program for modification and update

____________________________ Name

_________________ Date

Component E

Resources

Purpose

Component E contains several of the forms (logo removed, perforated) discussed in the Resource Guide. A glossary of CBE terminology is also included in Component E.

Table of Contents

Glossary (467-469)

Forms
- Task Listing
- Task Analysis

- Student Learning Guide
  - Cover Page
  - Objectives
  - Learning Activities
  - Instruction Sheet
  - Self Check (directions)
  - Self Check
  - Self Check (answer key)
  - Knowledge Test (directions)
  - Knowledge Test
  - Performance Test (directions)
  - Performance Test (standards)
  - List of Resources

- Syllabus
  - Cover Page
  - Course Descriptions/Task Inventory
  - Performance Objectives
  - Content Outline
  - Grading Procedure/References

GLOSSARY

Advisory Committee - A group of employers and employees from outside the field of education who advise educators on the establishment and ongoing operation of training programs.

Affective Domain - Attitude, emotion, values clarification and appreciation objectives are included in the affective domain.

Articulation - The process of granting credit from one program to another program. Articulation is the relationship of a training program at one level to a similar program at another level.

Cognitive Domain - Knowledge, thinking, understanding and problem solving objectives are included in the cognitive domain.

Competence - The ability to perform a task at a specified level of mastery.

Competency - See Task.

Competency-Based Education - A system of instruction that is based on industry validated competencies. Instruction is delivered with the individual learner foremost in mind. Students are evaluated on their ability to actually perform the skill in question. Competency-based education is also known as competency-based vocational education (CBVE), CBE, performance based education and mastery learning.

Criterion Referenced Evaluation - A testing (evaluation) technique that measures an individual's performance against a predetermined standard.

DACUM - An acronym for Developing a Curriculum. An approach to determining entry level tasks that relies on the input and expertise of individuals who are currently employed in the occupation being analyzed. This group of individuals meets and develops a chart of task statements.

Duty - A distinct major activity involved in performing a job consisting of a grouping of similar tasks.

Entry Level Skills - The skills that are required of an entry level employee.

Individualized Instruction - A method of instruction that takes the needs and learning styles of the individual student into consideration to determine his/her best learning method. Instruction is said to be individualized as long as instructional decisions are based on meeting the learning needs of the individual student.

Knowledge Test - A test used to assess mastery of knowledge (cognitive) tasks including both written and oral testing.

Learning Guide - A set of directions that guides a student through a variety of activities necessary for the student to be able to demonstrate mastery in a specific task.

Mastery - A level of performance or achievement that meets a specified occupational standard.

Module - A learning package that is self contained. Everything the student needs is contained in the module.

Norm-Referenced Test - A testing technique that is used to compare an individual student's performance with the performance of other students.

Open Entry - A program designed to allow students to enter a training program at any time. Normally CBE training programs are said to be open entry if they accept students on a monthly basis.

Open Exit - Students can "graduate" from a training program at any time as long as they have successfully completed the program competencies.

Performance Checklist - A list of critical process and/or product elements that a student's performance is compared to.

Performance Objective - A statement which describes what the learner must do to demonstrate mastery of a task. A performance statement contains a condition, behavior, and a standard.

Performance Test - A test used to assess a student's mastery of a psychomotor skill.

Performance Test Standards - See Performance Checklist.

Psychomotor Domain - Skill performance and "hands on" manipulative objectives are included in the psychomotor domain.

Self Check - An informal evaluation used in student learning guides to provide feedback to students.

Skill Test - See Performance Test.

Student Learning Guide - See Learning Guide.

Task - A complete useful unit of work actually performed by workers on the job. A job task is observable, has a definite beginning and ending point and describes exactly the product or service that is being produced or performed.

Task Analysis - A breakdown of the steps within a task.

Task List - A list of tasks that are performed in a specific occupation. CBE training programs are based on task lists.

Task Map - A graphic representation of the sequence (learning) a student would go through in order to complete a section of or a total training program.

Written Test - See Knowledge Test.

TASK LISTING

PROGRAM:

Task No.	Std. Hrs.	

Total Tasks	Total Std. Hrs.	REVISED:

TASK ANALYSIS FORM

TASK:		
Procedural Steps & Technical Knowledge	List each procedural step & technical knowledge required to perform task from start to finish on the job.	
Tools	List special tools, equipment, materials, etc. needed to perform this task:	
Related	Related math, science or background knowledge needed to perform this task competency:	
Safety	List critical safety knowledge and skills needed to perform task in a safe manner:	
Attitudes	List attitudes critical to performing task in a competent manner on the job:	

STUDENT LEARNING GUIDE

PROGRAM:

DUTY: ☐ ____________________

TASK: ☐ ☐ ____________________

INTRODUCTION:

PLEASE DO NOT WRITE IN GUIDE.

PAGE ____ __ OF ______

OBJECTIVES

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN:

YOU WILL:

HOW WELL:

ENABLING OBJECTIVES:

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE ☐

number

Enabling objective:

PROCEDURE	
LEARNING ACTIVITIES	RESOURCES

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INSTRUCTION SHEET FOR ENABLING OBJECTIVE ☐ number

PAGE________**OF**________

SELF-CHECK FOR ENABLING OBJECTIVE ☐
number

DIRECTIONS:

PAGE________**OF**________

SELF-CHECK FOR ENABLING OBJECTIVE ☐
number

PAGE________OF________

SELF-CHECK FOR ENABLING OBJECTIVE ☐
ANSWER KEY number

PAGE________OF________

KNOWLEDGE TEST FOR ☐ ☐ ☐
duty task number

DIRECTIONS:

KNOWLEDGE TEST FOR ☐ ☐☐
duty task number

PAGE________ OF 494

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

DIRECTIONS

PAGE________**OF**________

PERFORMANCE TEST FOR ☐ ☐☐
CONTINUED duty task number

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO

PAGE________OF________

LIST OF **RESOURCES**

Course Syllabus

Course Number:

Course Title:

Date:

Prepared By:

This syllabus has been reviewed and is current on the date indicated:

APPROVED	DATE

Course Syllabus

I. Course Description- Catalog description of the course

II. Task Inventory- List the tasks from the inventory which are covered by this course

Course Syllabus

III. A. Performance Objectives

Course Syllabus

III.B. Content Outline (optional if learning guides are in use)

Course Syllabus

IV. Grading Procedure

V. Student References

(texts, reference books, any other references the student will expected to use.)